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[Monthly Issue.]

Wednesday, June 8, 1892.

LIEUTENANT-GENERAL E. H. CLIVE, Governor and Commandant Royal Military College, Sandhurst, Member of Council, in the Chair.

MAGAZINE RIFLES, THEIR LATEST DEVELOPMENTS AND EFFECTS.

By Captain WALTER H. JAMES, late R.E., F.R.G.S.

IT is now some five years since I last had the honour of addressing an audience in this Institution on the question which forms the subject of my lecture to-day. At that time, 1887, the nations of Europe were only on the road towards adopting a magazine rifle armament for their armies, but at the present moment every Continental Army has adopted them, or is in the course of so doing. In some, as a tentative measure, the old rifles have been adapted to magazine fire, but in all the great Powers a small-bore rifle has been, or is now being, introduced. Germany has discarded the Mauser for a new weapon, Austria has gone over to the small-bore Mannlicher, France has the Lebel, Italy has adapted her old-fashioned Vetterli, but proposes to introduce shortly a small-bore rifle, and Russia, after some hesitation, has finally declared for a small-bore magazine rifle. These various changes are shown in Table A.

In the lecture to which I have alluded, I ventured to lay down certain propositions, viz.: that the magazine should be a central one, that the bolt would have a rectilinear motion, and that the calibre would be considerably reduced, lower than what was then considered admissible. Table B shows the principal dimensions and construction of the chief modern military magazine weapons, from which it will be seen that the central magazine obtains almost universally. The calibres have been considerably reduced, and the rectilinear action has been introduced in the Swiss and Austrian Armies. Here

I may say that the Mannlicher action is the only one which has stood the actual test of war, having been employed with great success in the late struggle in Chili.

Military opinion, therefore, appears to support the view I then took, although there has been as yet some hesitation in adopting the straight pull-back breech bolt.

Before comparing the merits of the various rifles, it would be well to lay down, in the form of propositions, the principles on which an ideal rifle should be constructed; these seem to me as follows:—

1. The bolt should have a rectilinear motion, because that enables the soldier to fire without taking the rifle from the shoulder.
2. The magazine should be central, and should hold ten or twelve cartridges.
3. The cartridges should be contained in a frame, or filler, so that they can be rapidly loaded into the magazine.
4. The cartridges should be easily taken from the holder for use in the weapon as a single loader.
5. There should be a cut-off, which should be so arranged as to facilitate the use of the weapon as a single loader.
6. The bore should be sufficiently small to enable a long bullet to be driven at a high velocity, so that at medium ranges, *i.e.*, within 800 yards, one sight will suffice for military purposes.

To all these points, except the first, I imagine a general consent will be given.

But the first seems to me very important also. For it enables the soldier to fire without taking the rifle from his shoulder, and this at very close ranges; when victory or defeat are trembling in the balance, every second gained is of importance.

The objection urged against this form of breech is that it is liable to open if the butt of the rifle be struck against the ground. This is true, although the objection seems to me of no moment, because the rifle cannot be fired when the breech is not locked.

The second proposition, so far as the position of the magazine is concerned, is, I think, universally admitted. But should the weapon only be used as a magazine weapon, as in the Austrian and German weapons, or as a magazine and single loader, as in the English and Swiss weapons? The latter seems to me the best, because it ensures more certainly the magazine reserve fire at the required moment, and because, the magazine being cut off, there is less chance of ammunition being wasted. The objections to it are:—

1. The increased weight of the rifle owing to the full magazine always carried about.
2. The fact that the soldier may not use his magazine at the critical moment, whereas with the systems which always fire from the magazine he can, when desired to increase the rapidity of fire, without having to go through any special motion to open the magazine. Opinions may differ as to the number of cartridges the magazine should hold. We have ten, the Swiss twelve; but, whatever number be decided on, it is very important that it should be possible to load the magazine quickly. This involves the use of some

form of frame or filler. I have here those used by the Austrians, Fig. 1, the Germans, Fig. 2, the Swiss, Fig. 3, and the Belgians, Fig. 4. Personally, I think the last far the best, because it does not go into the magazine and is the lightest. Moreover, its use allows a closed magazine, whereas the others must have a hole for the cartridge-frame to fall through.

The frame should allow the cartridges to be easily taken from it as a single loader, and should allow insertion either way. The only objection to packing the ammunition in frames is the additional weight to be carried; this is so small and the advantage gained so great that it may be neglected.

If you adopt my view with regard to the magazine, proposition 5 follows as a matter of course: a cut-off must be supplied, and this, I think, should take the form adopted by us, *i.e.*, a metal slide on which the cartridge rests when used as a single loader. This is better than letting the cartridge rest on the top of the magazine cartridges or on the top of the elevator, which is only supported by a spring.

And now as to the bore. This should be as small as possible compatible with sufficient stopping power in the bullet. Assuming the weight required for this purpose to be about 200 grs., the smaller the diameter the greater will be the capacity for the bullet to overcome the resistance of the air. You will see from Table B that most of the weapons now in use have a bore of about 0·3 inch. But the new Italian gun is 0·256, and many consider this a better size. Probably we shall see in the near future a rifle bore of not more than a quarter of an inch, although this would, of course, involve very long bullets, with all their inherent difficulties.

Mieg, the well-known German authority on rifles, has, however, suggested the use of the heavy metal wolfram, specific gravity 18, *i.e.*, nearly double that of lead, so as to obtain the required weight with a less length of projectile. General Wille has advocated the view put forward by his compatriot, in a work entitled "Wolffram Geschosse," which is well worthy of attention. The adoption of this metal would diminish the length of the projectiles by one-half, and thus avoid the defect of a very severe twist in the rifling.

Looking at Table B you will see that these modern weapons have a muzzle velocity varying from 1,968 to 2,336 ft.

I may state that the Swiss bullet in a 6·5-mm. rifle has attained a velocity of 700 m. at 25 m. from the muzzle of the rifle, *i.e.*, a muzzle velocity of about 2,400 ft.

Probably, as time goes on, we shall get still higher velocities, and we may look in the immediate future for 2,500 or 2,600 ft. muzzle velocity, or even higher,[1] *i.e.*, we shall see the rifles which will require for practical purposes but one sight up to 800 or 900 yards. These results may be obtained by further diminution in the calibre, which, while increasing the power of overcoming the resistance of the air,

[1] With a Hotchkiss Q.F. gun of 80 calibres over 3,000 ft. muzzle velocity have been obtained. A rifle is more than 100 calibres long, and there is, therefore, ample space to burn powder to produce the same velocity.

will still render possible the use of comparatively light bullets which can be fired by large charges without too great recoil.

All the bullets of the rifles in Table B have a hard metallic covering, except the Swiss, which has only a metallic covering at the point. You will remember that this casing was introduced to avoid the leading of the grooves and stripping of the projectile which occurred with long narrow lead bullets fired with high velocities. The Swiss certainly seem to have solved the problem of the paper cover, at any rate with the muzzle velocity they use, and I should imagine it would be worth while for us to experiment in the same direction, although recent experiments would seem to show that nickel iron is, on the whole, the best covering material, being sufficiently soft not to injure the barrel and not liable to rust, while it is much cheaper than copper. With regard to the shape of the cartridge, ours is, I think, far the best, as, owing to its coned shape, it is much less likely to jam than any of the others. The cartridges of Germany, Austria, and Belgium have a groove at the end instead of the ordinary base. The advantage of this is that the cartridge is packed more easily, and appears worthy of adoption.

The nature of the covering is shown in Table B. In savage warfare, no doubt, stopping effect is a great desideratum. This would appear to be better obtained by the Swiss form of bullet, Fig. 5, which has the advantage of costing less than the completely-covered projectile. The effect thus produced is shown in the photographs I have here. Bound up with the question of bullet covering is that of high velocities. As we know from experience, in this country there is a tendency with the new bullets to blow through their covers, as did the Minié base cup through the Minié bullet. This difficulty has we know been overcome for velocities now used, but still exists where much higher ones are employed. The bullet I have here is designed to avoid this. It is a very simple expedient; the cup is put round the other way (see Fig 6). With this alteration there can be no danger of the core coming through the covering. The effect of this bullet is enormous, as you will see from this iron plate. The bullet sets up, and its stopping power must be enormous. Of course it loses somewhat in penetration, but if this be sought after it can be obtained by putting a front cover on over the base one as shown in Fig. 7.

Rifles fired with high velocities heat so rapidly that some protection must be afforded to the soldier's left hand, or he cannot hold his weapon. This protection has been sought in the German rifle and French carbine by means of an outer steel tube. I doubt if this be so efficacious as our own wooden hand-grip. The Swiss have extended the wood almost to the muzzle.

Having now gone through the various points I have laid down, let me briefly discuss the various weapons which now form the armament of the different European Powers. These are:—

German rifle.
Belgian ,, Fig. 8.
Austrian ,,

Austrian carbine. Fig. 9.
Swiss rifle. Fig. 10.
French carbine.
English rifle.

In addition to which I shall draw your attention to the 0·256 inch Mauser, described in Table B.

The German rifle is well known, as it has been previously exhibited in this Institution.

The Belgian Mauser is an improvement on it; the bolt is strengthened: made simpler so as to be easily taken to pieces, while the frame is cheaper and lighter, and falls out when the cartridges are inserted in the magazine, which thus forms a closed box.

The Austrian rifle differs in no way from that which I showed some years ago in this Institution; the carbine has an improved form of straight pull-back (Fig. 10).

This appears to me to be a considerable improvement on the original Mannlicher bolt; the cartridge frame is the same as that used in the rifle; its rhomboid form is not so good as the rectilineal one of the Germans, which is in itself surpassed by the light frame of the Belgian.

The Swiss rifle presents many peculiarities; it has an excellent bolt system, straight pull-back, which is very carefully thought out in all its details, the only objection to it being that it is somewhat long, and, therefore, heavy. This, I think, could be modified, and certainly the bolt action is one of the best now in existence.

The French carbine has the Berthier bolt, the great feature of which is the fact that it contains no screws, and can be taken to pieces with the greatest ease by the soldier himself. It distinctly stands in the first rank of breech actions.

The English rifle you all know. The objections to it appear to me to be as follows:—Its bolt is extremely complicated, compared with the Berthier or Belgian Mauser bolt. These contain far fewer parts, and must, therefore, be the cheapest to manufacture. From the "American Year's Naval Progress" for 1891, I extract from p. 165 the following opinion on the relative merits of the Belgian Mauser and the Lee-Metford:—

"Its advantages over the English rifle are too manifest to require comment."

So long as we maintain the same cartridge, there is no need for uniformity of bolt actions in the Service, and I, for one, should certainly advocate the abandonment of the Lee bolt for one of a more modern, less complicated, and less expensive nature.

The English magazine must be loaded by single cartridges, as these are not contained in frames. The objection to this system is that when once the magazine is empty it takes too long to refill, and possibly, therefore, at the moment of great need, just when the magazine was most wanted, the soldier would only be able to use the rifle as a single loader, while he would most certainly be opposed in Europe by a frame-filled weapon. Surely we ought without delay to adopt a similar system for our Army!

Lastly, I would draw your attention to the ·256-in. (6·5-mm.) Mauser, which is practically the same, so far as breech action is concerned, as the other rifles manufactured by Messrs. Loewe. But you will notice that the muzzle velocity is the highest in Table B, and its penetration, Table C, very great, while the greater lightness of the ammunition would allow a larger number of rounds to be carried.

With regard to the effects of the modern military rifle, we must regard them from two different aspects:—

1. Those produced on troop formations by the wide range of the bullets and flatness of their trajectory, and their larger number of bullets fired.

2. The physical effects of the bullets on the human frame.

Dealing with these facts *seriatim*, it is evident that in the first case we shall find much deeper zones in which bullets will take effect, *i.e.*, that the probability is a larger number of men may be hit, and this is intensified by the fact that using the ordinary standing sight, there is a shot-swept zone of at least 700 yards, that is to say, for all practical purposes one sight only is required up to this distance. The French say that in action up to 600 m., *i.e.*, 660 yards, the 400-m. sight suffices. Our regulation is to employ the "fixed" sight within 500 yards, aiming at the feet. The German soldier goes into action with 150 rounds in his pouch, the French with 112, the Austrians 100, an increase in number over what was formerly carried, and which will certainly be used by the soldier under fire. In addition to which the immediate reserves are greater. Now, owing to ricochets and the dispersion of fire due to irregularities in shooting, a considerable space beyond the real range, probably 100 yards or greater, will be more or less swept by bullets. From this it evidently follows the front line and supports alike will be struck by fire aimed at the former. This will render it more difficult than ever to feed the shooting line, more difficult than ever to keep supports and reserves in hand, as they will suffer from the rapid fire aimed at the front formations. The use of guns which, employing curved fire, can remain longer in action than flat trajectory weapons, and thus keep the defenders under a powerful fire until the attacking troops are fairly close, seems a plain necessity, while some Continental authorities seem to think that the best formation for supports will be to advance in small sections from a flank, thus offering but very little lateral target to the enemy.

We have to consider in addition to the flat trajectory the effect of smokeless powder, or rather of powder which gives but little smoke. This is to the advantage of the defensive, inasmuch as the shooting will be no longer obscured by smoke, while the advantages of cover will remain the same. Moreover the position taken up will not be betrayed by the smoke coming from the rifles.[1] On the other hand, the offensive loses the shelter given by the smoke cloud, and thus the defenders of a position can better judge ranges,

[1] Guns will not be so much affected, for the brilliant flash is no longer obscured by smoke, and when the ground is dry the dust driven up by the explosion of the charge will show their station.

and pour in at close quarters a more than usually deadly fire. This points definitely in one direction, viz., to an increased necessity for preparation by artillery fire. This will be obtained in two ways, the one, in the case of deliberate battles by the guns taking up a position under cover of darkness, or by long-range indirect fire from guns the position of which is no longer revealed by their smoke, the other by an increased endowment of guns to the Army Corps. It is a curious fact that at a time when all the nations of Europe have increased the proportion of the artillery to the other arms, we in England have reduced it. The English Army Corps, presumably intended for service on the Continent, is no doubt chiefly a matter of academic interest, but, it is nevertheless remarkable that while France and Germany have increased the number of guns to nearly 5 per 1,000 we have reduced them to about $3\frac{1}{2}$. I presume that in course of time our extremely useless common shell will be replaced by some more efficient projectile, either one with a high explosive bursting charge or some improved method of fragmentation, such as the Austrian ring shell.[1]

The difficulties of observation due to long-range weapons will have a tendency to prolong deliberate battles, because of the caution needed before the assailant will commit himself to a definite line of action. He will as it were have to conduct a reconnaissance in force before entering on his main action.

There is another point to be borne in mind, the much-vexed question as to whether the soldier is to fire when advancing or not. Experiments have been conducted in France which seem to show that fair effects can be got provided the rifle is properly arranged for the purpose. If this be the case it is plain that the difficulty of passing over the last 200 yards of the attack is considerably lessened.

As to the effect of modern weapons on cavalry action on the battle-field, I feel some diffidence in opposing the general view that it may still do great things. This teaching seems to me largely due to peace practice, where no bullets are in the rifles. When the ground is favourable, and surprise more or less possible, no doubt cavalry may still be used, but under ordinary conditions to imagine that men and horses can live through a shot-swept zone of a thousand yards seems to me almost ridiculous. The magnificent spectacle of line after line of horsemen sweeping over the field is beautiful at autumn manœuvres; in war the physical obstacle formed by the falling men and horses would alone suffice to break up all formation if they did not altogether stop the advance.

The physical effects of the new bullets must also be considered. They have formed the subject of considerable experiment on the Continent, and I believe in England, although I can give you none of the English results, which are regarded as highly secret and confidential. I append to the end of this lecture (Table D) a list of foreign works which may be with advantage consulted on the subject. It seems to me that the position is somewhat as follows. The effect of bullets on the human body depends—

[1] This has been done with the 7-pr. jointed gun.

1. On the size of their transverse section.
2. On their velocity, *i.e.*, power of penetration.
3. On the amount of setting up undergone by the bullet after entry.

Plainly, the bigger the bullet the more damage it is likely to do, *i.e.*, the bigger the bore the greater the wound.

The setting up of a bullet acts in a similar way, as exemplified by an express rifle. Now, most of the modern bullets with their hard coverings do not set up much, unless at close ranges. Hence there is a tendency for wounds in the soft tissues, except when the express effect of the bullets takes place, to be cleaner and less dangerous. On the other hand, the high velocity will drive a bullet farther, and hence it may penetrate several men, as was shown in the late suicide in the Vienna Barracks; and where the new bullet strikes a bone, at close ranges, extensive splintering takes place, more so than with the lower velocity bullets, although these may be a bigger bore.

The small-bore bullet, if it penetrate the cavity of the chest or the abdomen, may be as dangerous as the big.

Dr. Enrique Deformes, of the Chilian Hospital of San Juan de Dios, has published in the "New York Herald" the result of his experience of the effect of the Mannlicher bullets in the Chilian War. He sums up as follows:—The flesh wounds caused may in a large percentage be classed as in nowise serious and easily curable with proper care, unless in grave cases of hæmorrhage of an artery or vein or peritonitis. Similar conditions prevail in cases of fracture of the smaller bones. The fractures of the larger bones are larger in size than those inflicted by other projectiles, but so long as proper antiseptic means are employed they are of easier treatment. These results are, Dr. Deformes believes, due to the composition and construction of the Mannlicher bullet.

Dr. von Bardeleben, a Surgeon-General, and one of the leading doctors of the Prussian Army, bears out in general the deductions of Dr. Deformes. His views are as follows:—

In a modern battle the number of wounded and also the number of immediate deaths will be larger than formerly. But, on the other hand, the proportion of recoveries among the wounded removed from the battle-field will be greater, because the extensive splintering of bones will less often occur, and because the track of the bullet, being smaller and cleaner, will be less liable to septic influences. Moreover, a larger proportion of the wounded than heretofore will require only slight treatment, and bullets will not so often be found remaining in the body, and thus on the whole the surgeon may look for a favourable field for the display of his ability.

Penetration of the Projectiles.

This has of course enormously increased, the increase being due to the high velocity and to the fact that the hard covering prevents the projectile from being deformed. Table C shows the penetration of

some of the modern bullets. An iron plate nearly $\frac{1}{2}$-inch thick was penetrated by the Swiss bullet at 10 m.

To sum up, it seems to me that considering the experience we have now gained we might pause before finally adopting the Lee-Metford rifle. It possesses an action needlessly complicated and costly to manufacture. The Mauser, Berthier, and Mannlicher bolts are superior and cheaper. If the barrel be maintained, although I should prefer a smaller bore, then the muzzle velocity must be raised as high as possible without undue strain or increasing too much the recoil. The cartridges should certainly be packed in frames. With these modifications we should possess a high-class weapon equal to any now being adopted by other countries, although I cannot help seeing we should do wisely to at once adopt the minimum calibre.

TABLE A.

Present Infantry Armament of European Armies.

Country.	Magazine.	Single-fire.	New small-bore.	Old large-bore adapted.
Austria	Yes.	..	Yes.	
Belgium	Yes.	..	Yes.	
Bulgaria	Yes.	..	Yes.	
England	Yes.	..	Yes.	
France	Yes.	..	Yes.	
Germany	Yes.	.	Yes.	
Italy[1]	Yes.	..	..	Yes.
Roumania[2]	..	Yes.	..	
Russia[1]	..	Yes.	..	
Servia[2]	..	Yes.	..	
Switzerland	Yes.	..	Yes.	
Turkey	Yes.	..	Yes.	

[1] Has just chosen a new pattern (see Table B).
[2] New pattern small-bore under discussion.

TABLE B.—*The Latest Patterns Magazine Rifles.*

Country.	Weight.	Calibre.	Weight of bullet.	Bullet covering.	Muzzle velocity.	Sighted to	Position of magazines.	Rounds in magazines.	Cartridges in frames.	Cut-off to magazines.	Bolt action.	
	lbs. ozs.	in.	grs.		feet.	paces.						
Austria	9 10	·315	242	Steel	1,968	2,500 metres.	Central	5	Yes	No	Straight	
Belgium	8 2	·301	219	Nickel.	1,980	2,050 yards.	,,	5	Yes	No	Turns	
England	9 4	·303	215	Alloy of nickel and copper	2,000	2,900	,,	10	No	Yes	,,	
France	9 4	·315	216	Maille-chort[1]	2,073	metres. 2,000	Tube	8	No	Yes	,,	[1] An alloy of copper, nickel, and zinc
Germany	8 6	·311	223	Steel[2]	2,034	2,050	Central	5	Yes	No	,,	[2] Plated with an alloy of copper and nickel.
Italy	8 4	·256	..	..		..	,,	5	Yes	No	,,	
Russia	9 8	·300	215	Nickel	2,000	..	,,	5	Yes	No	,,	
Switzerland	9 10	·295	211	Steel[3]	..	2,000	,,	12	Yes	Yes	Straight	[3] Plated with an alloy of copper and nickel.
Mauser	8 6	·256	155	Iron	2,336	2,000	,,	5	Yes	No	Turns	
					Carbines.							
						Paces.						
Austria	..	·315	242	Steel	..	2,400	Central	5	Yes	No	Straight	
France	..	·315	216	Maille-chort.	..	..	,,	3	Yes	No	Turns	

TABLE C.

Showing the Penetration of Modern Rifle Bullets into various Substances.

Range.	Rifle.	Materials.				
		Earth.	Deal.	Oak.	Iron.	Steel.
		ins.	ins.	ins.	in.	in.
10 m. (11 yds.) ...	French.	10	36	8	0·47	0·39
200 m. (220 yds.) ..	„	18	24	11	0·24	0·16
500 m. (550 yds.) ..	„	16	20	6	0·16	0·08
100 m. (110 yds.) ..	German.	36	32	..	Up to 300 m. (330 yds.) traverses 0·28 in.	*
400 m. (440 yds.) ..	„	20	18			
800 m. (880 yds.) ..	„	14	10			

With the English rifle the following thicknesses are considered proof at any range :—

Earth, 24 ins.; iron or steel plate, 0·365 in.; fir, 38 ins.; oak, 24 ins.: one "header" or two "stretcher" sandbags.

The ·256 rifle given in Table B penetrated thirty 1-in. elm boards ½ in. apart at 40 yards, the bullet not suffering deformation.

TABLE D.

Foreign Surgical Works dealing with the effects of the New Small-bore Rifles.

Josef Bogdanik, "Die Geschosswirkung der Mannlicher Gewehre" in the "Wiener Klinik," 1890, Part 12, pp. 308–336; and in "Der Militärarzt," 1891, pp. 22 and 23.

Paul Bruns, "Die Geschosswirkung der neuen Kleinkaliber-Gewehre. Ein Beitrag zur Beurtheilung der Schusswunden in künftigen Kriegen."

Delorme et Chavasse, "Étude comparative des effets produits par les balles du fusil Gras de 11 mm. et du fusil Lebel de 8 mm."—"Archives de médecine et de pharmacie militaires." 1891. Pp. 81–112.

Johann Habart, "Die Geschossfrage der Gegenwart und ihre Wechselbeziehungen zur Kriegschirurgie."

Zuneshaburo Kikuzi, "Untersuchungen über die physikalische Wirkung der Kleingewehr-Projectile, mit besonderer Berücksichtigung des Kaiserlich Japanischen Ordonnanzgewehrs System Murata."

A. Koehler, "Bericht über die chirurgische Klinik," &c., in the "Charité-Annalen, XIV." Jahrgang (1889), p. 574.

A. Koehler, "Historische Untersuchungen über das Einheilen und Wandern von Gewehrkugeln."

Ernst Reger, "Die Gewehrschusswunden der Neuzeit."

Ernst Reger, "Die Anforderungen der Humanität an die Kleingewehr-projectile. Deutsche militärärztliche Zeitschrift." 1884. Part 12, p. 575.

Ernst Reger, "Neue Beobachtungen über Gewehrschusswunden. Deutsche militärärztliche Zeitschrift." 1887. Part 4, p. 151.

O. Schickert, "Zur conservirenden Behandlung der Schussverletzungen des Kniegelenks."
Victor Wagner, "Ueber die Indicationen zu operativen Eingriffen bei der Behandlung von Schussverletzungen in der ersten und zweiten Linie."
Zwicke, "Bericht über die chirurgische Klinik des Prof. Dr. Bardeleben pro 1880," in the "Charité-Annalen," VII year (1882), p. 560.

Lieutenant J. W. HEATH: I should like to ask Captain James if the velocities given are with the old powder or with the smokeless powder, or cordite.

Captain JAMES: Smokeless powder, all of them.

Major PALLISER: I wish, Sir, to say a few words on this subject in justice to Mr. Lee, a friend of mine, who is in bad health in America. The rifles which we see with the magazines, in the position in which he was the first to place them, are all more or less copies of the Lee Magazine Rifle now adopted in the British Service; and I may go further and say that the infringement of his patent is admitted abroad, a very important point, showing that Mr. Lee was the first to introduce the magazine in the position in front of the trigger bar. He always advocated that the magazine should be detachable, and I think that the Small-Arms Committee took that view, for our magazine is detachable. The Committee did not recommend that it should be used as a detachable magazine, for experience only must tell whether it is advisable or not to use that system. With regard to cavalry, I think the detachable magazine will be of the greatest service. Of course the mounted soldier can carry these magazines on the pouch belt, and he can also carry a great many more cartridges than the infantry soldier can carry; moreover, he can move at a very rapid pace. I maintain, therefore, that each individual cavalry man will become a sort of human machine-gun, able to move at the rate of 15 miles an hour on a pinch; and, therefore, 50, 60, or 100 cavalry soldiers thus armed will become formidable in our small wars;[1] hence these detachable magazines, being very strong and not likely to get out of order, will prove more valuable than the "filler." If my friend, Captain James, had been on a rough and tumble campaign, as very probably he has been, where the transport is inferior, he would probably decide that these "fillers" would get distorted. They are too rickety. It is all very well in Austria, France, and Germany, where they have fine roads, plenty of wagons and railways to carry ammunition in that form, but I venture to say, when I was on the campaign in Canada six years ago—very rough and tumble work—that all these "fillers" would have been out of shape in the first ten days. They could not stand a month's rough work such as we had. I think, therefore, they are utterly unsuited for our warfare, which is altogether different from Continental warfare. I consider the strong magazine that the Committee has adopted is the best for the purpose. It carries ten cartridges, and, on a pinch, the soldier can carry a spare magazine, and, with that spare magazine, there is no necessity for the "filler." The question appears to be, can that spare magazine be rapidly used? I tried it, by permission of the Officer Commanding the 10th Hussars, and found that Sergeant Beckwith could move at a gallop 150 yards, during which he took the detachable magazine out of its pouch and loaded his carbine without the slightest difficulty. Therefore the detachable magazine, in case the Commanding Officers

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[1] Major-General T. B. Strange, late R.A., who commanded the Alberta Field Force in 1885, will, I believe, confirm my statement as one of his Staff Officers, that the greater part of the fighting he had to attend to was done by his cavalry armed with magazine rifles: and that, though they were only 100 strong, their armament of magazine rifles, which they knew perfectly how to handle, appeared to give each individual remarkable confidence. In such work as they were engaged in the *arme blanche* would have been useless. For the majority of combats our cavalry have to maintain, I recommend, therefore, a good magazine rifle with spare magazines, and certainly no ricketty "fillers." In fact the rifle selected by the Small-Arms Committee would appear to fulfil all conditions.

desire them, would be an advantage. It is evident that a soldier could load his carbine much more rapidly at the gallop by means of the detachable magazine than by trying to stick one of these "fillers" into the empty magazine. It would be a very important and useful experiment to try. Nothing could be easier. All that is necessary is to give the soldier a carbine with the detachable magazine, and a carbine with the "fillers," and then see how he would get those "fillers" in at a gallop.

Major-General KEITH FRASER, C.M.G.: I have hardly any right to speak on this subject, being a cavalry soldier, but having had a great deal to do with magazine rifles, with the Mannlicher, the Schouloff, and other Austrian rifles, I venture to say a few words. One thing I should like to know is the number of cartridges which it is advisable to have for the magazine. In England we have ten—a large number. In France they have at present eight; but I understand Captain James to say that they are thinking of reducing that number to four. The Swiss have a very large number, I believe twelve. I remember, some years ago, Mr. Mannlicher telling me five was the outside he would trust in a magazine, for he thought that a man after he had fired five rounds would probably lose his head and not know how many he had to fire. A man might, perhaps, just keep count for the five, but he would lose count after that. I have had Austrian inventors showing me their rifles, and I have seen an Austrian inventor lose his head when firing his own rifle even, and forget the number of rounds. The result was, he threw out loaded cartridges, put in new packets, and sometimes fired more away after the magazine was empty. I should like to know what the opinion of infantry Officers is as to whether five, ten, or twelve is the best number for a magazine rifle. The lecturer has spoken with regard to cavalry. He appears to think that cavalry on a battle-field are useless, that their day has gone by. We are few in number certainly in England, therefore our opinion is not often expressed nor much attention paid to it, but we have one or two great men on our side who think that the day of cavalry has not gone by. Moltke was, perhaps, the greatest authority in Europe, and he has said that the rapidity of fire at the present day, and the great losses on the battle-fields will give cavalry, owing to its rapidity of movement, immense advantages that it never had before. They will be able to move from under fire, and it will be difficult to keep their range, whereas when infantry come into the zone of fire it is not easy for them to get out of it. Cavalry can come from the horizon, from "hull down," as it has been said, in a few minutes, and can sweep down upon the infantry. I do not say that any cavalry Officer would be insane enough to charge infantry that was not broken, or to charge them in front on level ground to be shot down all the way; but as long as there is dust and smoke, and rain, and mist, and undulating ground, it will be quite possible for cavalry on the battle-field to reach infantry, and, perhaps, in fogs, or in the dark in the evening to come down upon its flank. I therefore think that the days of cavalry in the battle-field are *not* over. We know what Hannibal did with his cavalry; we know that in the time of Napoleon weapons and projectiles had greatly improved, and yet it was the old story. It was the same thing at Custozza, where we saw three sections of a squadron of cavalry defeat an enormous mass of infantry and cause the winning of the battle. Armies are not *always* composed of philosophers. Dr. Johnson says, if an army were composed of philosophers there would be no possibility of panic; but with these awful weapons which are going to kill nearly everybody, I do not think that the few remaining would feel absolutely safe if they saw an enormous line of cavalry coming down on their flank at a critical moment. I think that there is still a chance for us. I do not wish to see cavalry men made into machine-guns as has been suggested, but I think at the same time the repeating carbine is more necessary for cavalry than ever. If we take a place we ought to be able to hold it, and to assist in that operation I think that long-range carbines with magazine rifles are, perhaps, more necessary than ever they were, and with their help we shall do very well in the future.

Captain EGERTON, Seaforth Highlanders: There is one point that has always struck me as having been somewhat exaggerated, and that is the necessity of employing either a somewhat heavier bullet, or one that, as the lecturer says, "sets up" a little more on striking the human body. My

opinion is the average human being, whether a European or not, does not require more than one bullet as a rule to stop him; certainly, speaking from my own personal experience, I do not believe that the average European, at least, ever wants more than one. There are exceptions, no doubt, but if he gets one he has had enough for that day. There is another point—I do not know whether it rightly comes into this lecture or not—which I consider very important, that is, the question of the particular nature of the troops which are in the future to be able to enjoy practice with the weapon that the lecturer has described, which will possess such an enormous amount of initial velocity, and therefore I presume a greatly increased range of fire. I do not allude so much to the Regular troops, or to the Militia, but I speak as regards the Volunteers. In the district in which I have the honour to be the Inspector of Musketry, there are some 383 ranges, and a comparatively small minority of these will, I fear, be safe for this rifle. In the case of the other ranges which are not safe, what is to happen to the Volunteers who are using them? I do not allude so much to the town corps, which can go away by train, as in London and Glasgow, but I refer to the small and scattered country companies. The result will be that a large number of ranges will disappear, and I regret to say that I am confident that with the ranges the Volunteers will disappear also. I consider that this is going to be one of the most important and serious facts that the country will have to face, and unless something is done, I really do not see how we are to avoid a large diminution in the numbers of the Volunteer force in this country, owing to the introduction of this rifle. I have alluded to this particular matter elsewhere, in a paper I recently read before the East of Scotland Tactical Society, but I venture to bring it forward again, as I think it is a point worthy, perhaps, of a wider circulation.

Colonel MALCOLM GREEN: There is one small question I should like to ask Captain James with reference to that sketch on the blackboard. Is the casing in which the bullet is placed supposed to accompany a bullet to the end of the range, or to leave it?

Captain JAMES: It accompanies it to the end. I have drawn it apart from the bullet so that you may clearly understand how it is put over the bullet. As a practical fact, the bullet is solid in its case.

Colonel NOLAN, M.P.: May I ask Captain James a question? He said he hopes that the new rifle will have a very high velocity, "so that at medium ranges, that is within 800 yards, one sight would suffice for military purposes." If you fire with a rifle sighted for 800 yards, even if gifted with a very high velocity, the bullet must fall 16 feet in 800 yards; if you fire with the same sight at 400 yards, the line of sight will be 8 feet above the object, and the bullet would fall only 4 feet. It must therefore go 4 feet over the point you aim at when you employ a sight fixed at 800 yards for a range of 400 yards. You may compromise by using a sight fixed for 600 yards, but then your bullet will go 2 feet over at 400, and 3 feet under at 800 yards. A variation of 2 or 3 feet would not matter so much when firing at a man standing up, but how are you to meet the case of a man lying down? It seems to me, if you use only one sight, from 100 to 800 yards, your good shot at 400 yards will be going 2 or 3 feet wrong when aiming at a man lying down, and the better the shot the greater will be the evil. If a man were standing straight up you might not miss, but if he is lying down you will very often. It seems to me that those who hanker after a solitary fixed sight are always only considering men standing up, and they never seem to consider the question of firing on a man either fighting under cover or lying down.

Lieutenant T. W. HEATH, Supply Officer, North London Volunteer Brigade: I should like to ask Captain James if he has the latest improvement of the sights of the magazine rifle. I have the honour of representing the South London Rifle Club. A fortnight ago we had a match against the School of Musketry at Hythe, and we were very handsomely beaten, we shooting with the Martini, and they had the magazine rifle with improved sights. I think the sight invented by, I believe, Mr. Rigby, was a very good form of sight in one way, but a bad form in a soldier's point of view. The square hollow backsight has a square block foresight, which must be brought in line with the object, and it takes some considerable time to align them. It takes a long time to align this sight. I tried it personally several

times, and from practical experience, as an old rifle shot, I found that when once you got the alignment, you could get very good shooting, but the time it takes to align it is a defect, especially for rapid firing. It is very well for the military breech-loader with which I shoot at Bisley. With a military rifle it is necessary to have a form of sight, which I am pleased to see has been improved on by the Hythe School of Musketry by filing the old backsight down and barleycorn foresight, so that you take the sight exactly the same as with the Martini. They made very good shooting. I was pleased to see that, because in a match of that kind against the picked shots of the Senior Rifle Club in England, it shows that the improvements have made the rifle better than the I, II, and III Marks. I believe that was Mark IV, but I understand they have given it the name of Mark I. I suppose the authorities do not like to admit so many Marks in the rifle after being passed by experts. I know that was the opinion of the authorities that it should be called Mark I. I am very glad of that alteration, because it has improved the rifle immensely. I had the honour some few years ago of being selected by the National Rifle Association at Wimbledon to fire the first magazine rifle made. The detachable magazine held five cartridges, and the very thing occurred to me that has been mentioned. I was firing at 200 yards to see what I could do in one minute. I fired twenty-five rounds, and then the very same thing occurred to me. I snapped off the rifle six times and had not a cartridge. Of course any hitch that way is liable to upset one and throw you off. I mention this to corroborate what has been said by General Keith Fraser. Having fired the first magazine rifle made, I thought he would like to hear that his statement was corroborated by my own actual practice at Wimbledon.

The CHAIRMAN (Lieutenant-General Clive): Gentlemen, I am sorry that absence on duty has prevented Colonel Slade from taking the chair. Colonel Slade is Commandant, School of Musketry at Hythe, and is thoroughly conversant with rifles and their projectiles, and his opinion would have been very instructive. My only qualification to replace him is that during my service I have fired with no less than six different weapons. I began with "Brown Bess" in 1855, an ancient but yet a percussion musket. In the Crimea we got the Minié rifle. That was followed by the Enfield, the Snider, the Martini-Henry; now we have the Lee-Metford; and the results of thirty-five years' work in the attempt to produce a perfect weapon of destruction have been collected by Captain James, and lie on the table before you. Although it does not follow that a rifle with a flat trajectory will make the most accurate weapon, it will yet make the most destructive one for military purposes. The flat trajectory is best given by a bullet whose length considerably exceeds its diameter, and which (for accuracy on impact) must travel end first at a high muzzle velocity. Such a bullet, however, will not travel end first unless you give it a spin, which is done by grooving the barrel. The giving of this twist requires strong explosive power in the powder to force the bullet into the groove and to give it muzzle velocity when it leaves the barrel. And lastly, when we have powder and barrel there comes the problem of the bullet, the present difficulty. We require a bullet which shall have an outside jacket soft enough to take the form of the grooves and yet have the proper hardness to prevent the core being driven through the bullet, which, when it occurs, renders the rifle useless for the day, until removed. That is what we are looking for. The lecturer has chiefly dealt with facts, and they have not been disputed in the discussion. I propose not to interfere between Captain James and General Keith Fraser as to the probable utility of cavalry on the field of battle. My opinion rather agrees with Captain James. On the other hand, I quite agree with General Keith Fraser that the accidents of the ground of the battle-field may give opportunities for cavalry action. The destructive power of small-arms and of guns will compel the offensive to work more from cover of ground or of woods, or at night, as in Egypt before Tel-el-Kebir, which will require stronger discipline and more intelligence on the part of the soldier. I agree with General Keith Fraser to this extent, that in the confusion of battle the possibility of getting to a flank may enable cavalry to find a part to play and possibly to carry out with great success. I think there is a little danger of reducing the size of our bullet so much that its effect on the human body is not mortal or disabling, and perhaps for some of our semi-savage enemies

it might be better to have a heavier bullet. Captain Egerton spoke about Volunteer ranges. I think that is to the point. There is no doubt these bullets do travel a long way, and if there should be many accidents from the rifles a great many ranges will be stopped, and that will be a very serious thing for the constitution of the Volunteer Force. Colonel Nolan said that for fine shooting it is not sufficient to have a flat trajectory that will hit a man all the way down the range. If you want to shoot as for bullseye shooting, the refinement of accuracy, I should very much doubt whether you would get it with a single-sighted rifle to 700 yards. It will do all very well so long as the enemy is standing up, but it will not do for men lying down or for match shooting. I will now ask Captain James to reply.

Captain WALTER H. JAMES: There appears to be very little for me to reply to. I must first of all say, with regard to what Major Palliser said, it always does seem to me that Mr. Lee has had scant justice done to him. He is undoubtedly the father of the central magazine. Years ago he invented it, and all these other magazines are more or less plagiarisms of his original invention. The central magazine, as I pointed out five years ago, was the coming magazine, and since then there is no Power that has adopted anything else. I am not an inventor; I have nothing to do with any rifle in existence. I have always carefully kept myself in the impartial position of a critic, and that is impossible if one has any share in a rifle. With regard to the detachable magazine: I feel very strongly on the detachable magazine, and I believe it to be an enormous mistake to introduce it. It is a sort of thing you will never have when you want it, and to say that it is better than the filler, is, to my thinking, a mistake. A filler of that kind (showing the Belgian frame) is not rickety; it is as strong as you can make it. It is a little steel bar. I do not say that all I have shown are perfect fillers, but I do say that one used in the Belgian Mauser has all the advantages of the detachable magazine and none of its disadvantages. One detachable magazine would weigh just twenty of these frames, and that alone is a good reason why we should rather have the frame than the detachable magazine. And, in the rough and tumble of a campaign, I think a detachable magazine is much more likely to come to grief. It must be thin, either thin steel or brass, and in the kind of country Englishmen habitually fight in, I think you will find the magazine itself would be extremely liable to deformation, far more than a simple carrier like the filler for the Belgian Mauser. It is all very well to take the one instance of the use of the spare magazine from one man. What you have to think about is not one man galloping on horseback, but 10,000 infantry soldiers on foot and 10,000 more within 200 yards, and at such a moment I believe that the somewhat complicated process of detaching a magazine to put another on is not as likely to be properly carried out as the simple process of putting this frame into the magazine, in which process you can attain a high state of perfection by daily drill. With regard to what General Keith Fraser said, I know he and I differ on that particular point. It is a matter, if I may venture to say so to him, that is always put forward that cavalry are to do these things; but from the days of the invention of rifles, onward, I do not know an example except the well-known case at Mars-la-Tour, where a great cavalry charge has been successful. The Custozza example was a small one.

General KEITH FRASER: A small force of cavalry.

Captain JAMES: A large force of infantry in disorder, more or less.

General KEITH FRASER: No.

Captain JAMES: They had been marching wearily forward when they were suddenly rushed on.

General KEITH FRASER: No, marching forward into position.

Captain JAMES[1]: But take the case of Margueritte's charge at Sedan; there is

[1] General Fraser did not state what particular cavalry attacks at Custozza he alluded to. But I think anyone who reads the Austrian official account ("Österreichs Kämpfe im Jahre, 1866," of which a bad French translation, "Les Luttes de l'Autriche," &c., also exists), will see that in the case of Bujanovic's brigade and the Emperor's Hussars, both of which broke squares, that the quality of the Italian troops attacked was not of the highest grade. The same remark applies to the Sicilian

a typical case. The cavalry came downhill; the ground was favourable for a cavalry charge, but they practically did no harm to the Prussians. I do not deny, I shall always believe, that there are opportunities for cavalry in small forces on the battle field, but I do not believe in large massed charges, because it seems to me it can be so rarely that these can be conducted under the conditions of surprise which is the postulate for the success of any cavalry charge. But I am quite certain, although the cavalry may somewhat, in that direction, have their *rôle* in future warfare diminished, that their *rôle* in warfare in general is very largely increased. For instance, take deliberate battles to be fought in any European war: the *rôle* of cavalry will be a great one, especially when it is armed with a proper magazine carbine. They may carry out great turning movements in large masses. The first intimation to their opponent will be a cloud of dust on his own cavalry driven back. It is all very fine for him to argue that behind that—the advancing cavalry—there will be nothing else. He does not know it, and therefore the moral, as well as the physical, effect of cavalry, and in this way, in future war, will have the very greatest influence on the issue of the fight. But I am inclined to doubt whether, on the actual battlefield, we shall see anything more than charges executed by small parties of cavalry. These always have been executed and always will be, and where they are enabled to introduce the element of surprise, they may be successful. In the last German manœuvres there was a striking instance of a Uhlan regiment charging and with the greatest effect. I quite agree with what General Keith Fraser says, that he does not want to see cavalry turned into the animated machine-gun of Major Palliser. I am sure he is right there, because the true weapon of the cavalry soldier is the *arme blanche*, whether the lance or sword. His duty is to get to handy strokes, and on the doing so depends the success of his action. With regard to the "setting-up" question to which Captain Egerton alluded, I am very much inclined to agree with what he says. I think for savage warfare it is undoubtedly desirable to have more stopping effect than you require in European warfare. I remember being very much struck with a Zulu I saw, who surrendered after Ulundi. He had been at Isandlwhana and he had been shot through the lung and the bullet had broken the shoulder-blade. He could not lift the arm; you could see the shoulder-blade in pieces beneath the skin, but nevertheless the man really did not appear to be any the worse from the result of his terrible wound. No European would have lived through that, but savages appear not to have developed that high organization that renders men of civilized nations more liable to die. Of course long-range weapons require long-range sights, but although it may be difficult to devise this, it cannot be a reason why we should stop short at a short-range rifle when other nations are going in for a long one. With regard to what Colonel Nolan said as to fine shooting, I draw a great distinction between fine shooting at a target and shooting on the battlefield. I do not believe when men are advancing against you, when your nerves are not in the state they are in at the present moment, that you can really obtain that fine adjustment of sights which you want for fine shooting; and it is far better to have a system of sighting which will enable you to use fine shooting at target practice and at the same time give the one sight on the rifle which shall be for practical purposes sufficient for shooting up to 800 or 900 yards. With regard to shooting at your enemy lying down, my advice would be the same as that given by "Punch" to those about to marry—"Don't." If your enemy is lying down at 800 yards, you had better keep your bullets in your pouch, and as he cannot crawl forward on his stomach from 800 yards up to the point which you are occupying, you will have lots of opportunity of firing your bullets into him when he is erect on his legs. This seems to me, again, an argument for the one practical sight which does not presuppose an iron nerve. We all know that soldiers are very brave men, but their nerves are not always as good under fire as they are in the barrack square. I think that is a fact we should take into consideration, and that, therefore, the one

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Lancers charging Forli's and Pisa's brigades. Pulz's charge near Casetta was made against men retreating in disorder, while his later operations and Bujanovic's were not successful, the latter Officer being wounded and taken.

practical sight is, to my mind, the sight for use in actual shooting against an enemy who is shooting against you. With regard to Mr. Heath's question about sights, I have a Mark II rifle here. Most foreign nations have the older form. The question which is the best is one that I cannot settle; there is as much to be said on the one side as the other.

The CHAIRMAN: I am sure you will allow me to thank Captain James, on your behalf, for this very interesting lecture.

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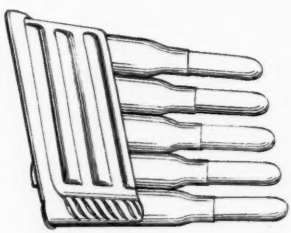

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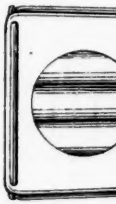

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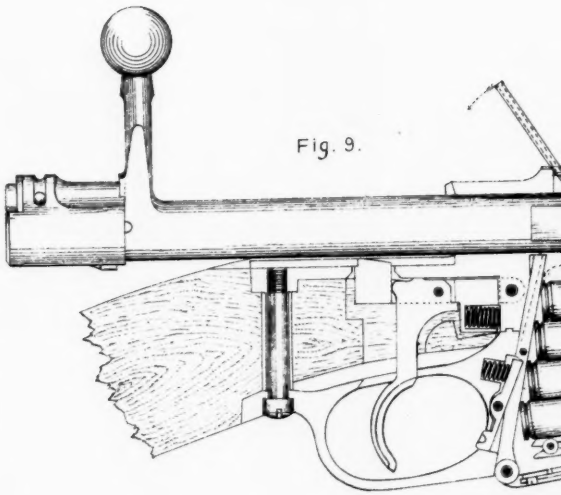

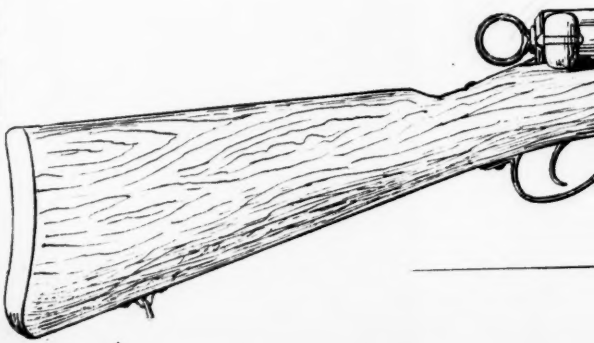

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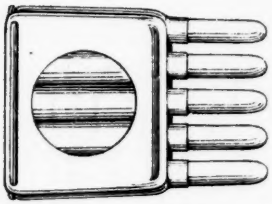

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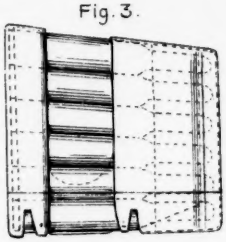

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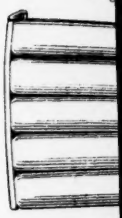

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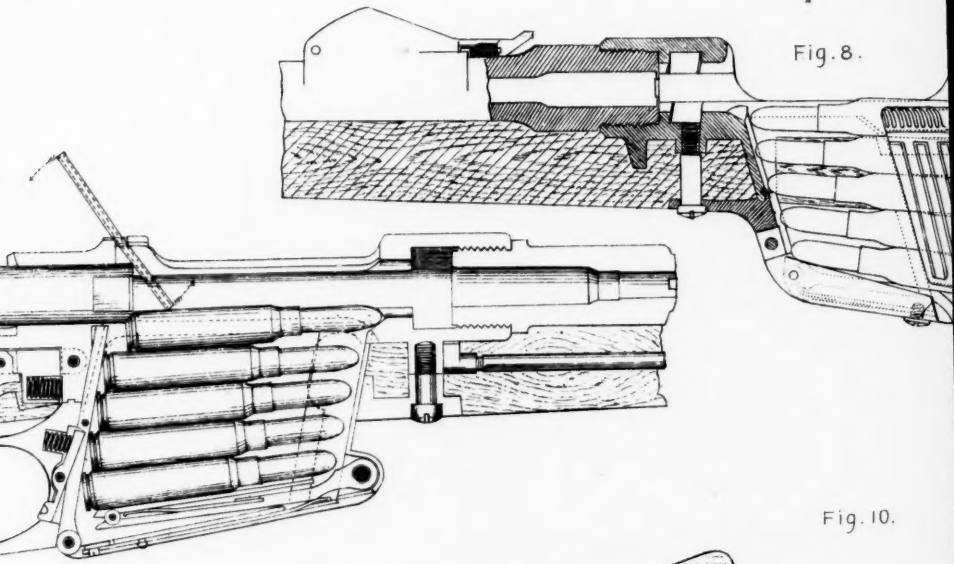

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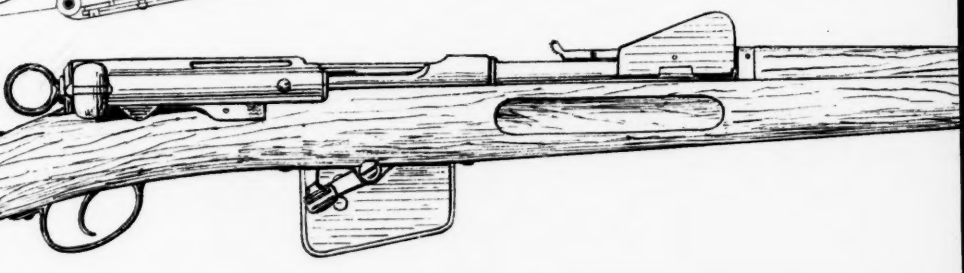

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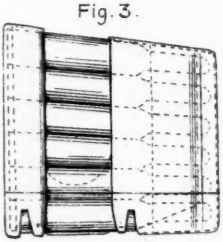

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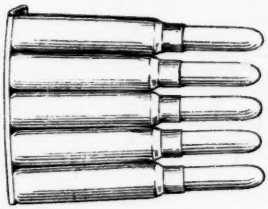

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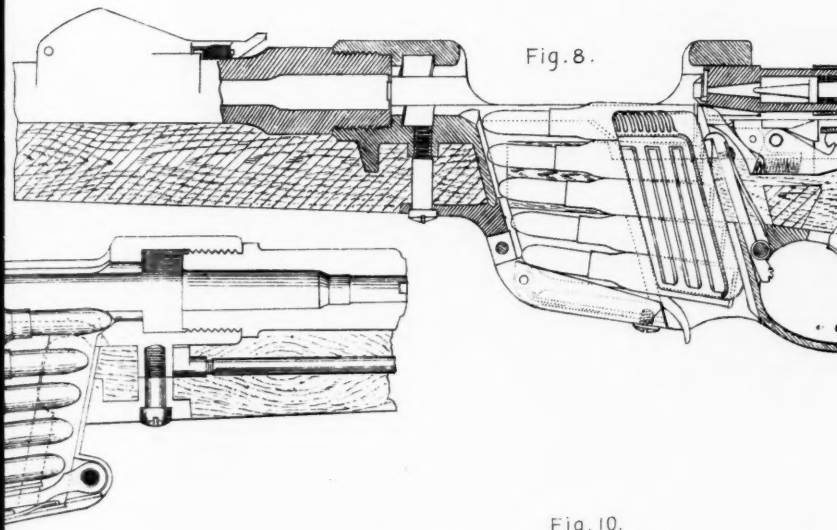

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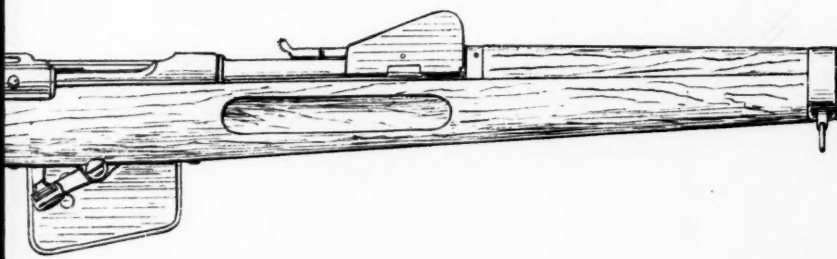

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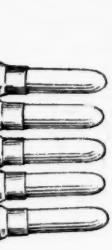
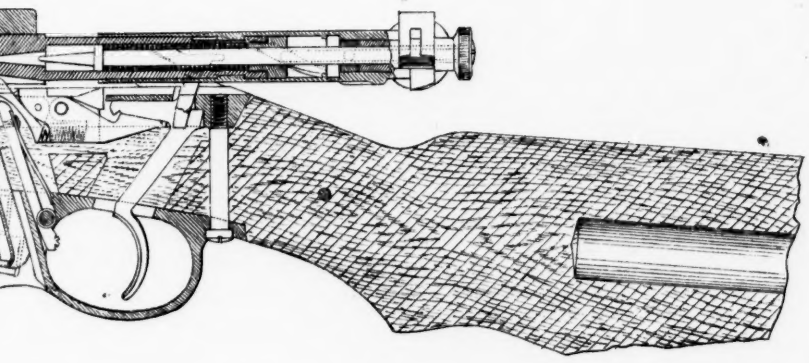


Fig.5.

Fig.6.

Fig.7.



Friday, July 8, 1892.

MAJOR-GENERAL J. KEITH FRASER, C.M.G., Inspector-General of Cavalry in Great Britain and Ireland, in the Chair.

SADDLES.

By Colonel the Hon. H. G. L. CRICHTON, Commanding Hampshire Yeomanry.

THE subject about which I have been asked to lecture is a wide one, and includes a variety of different descriptions of saddles. I propose to confine my remarks to the military saddle.

There is an old saying about putting the saddle on the right horse, but the greater difficulty always has been rather to put the right saddle on the horse, and this difficulty has existed in a great degree ever since the experiment was first tried, but I feel fully convinced that a better saddle might be placed upon the English cavalry horse than he has been made to carry of late years; and I believe that the public lectures which have been given in military societies, such as the one in Dublin by Veterinary Lieut.-Colonel Thompson and at Aldershot by Veterinary Captain Smith will be of the greatest benefit by drawing the attention of regimental Officers to what is below the surface of the horse, and so showing where the pressure may and where it may not be placed.

A horse is the most patient of sufferers, and to a certain extent a cavalry Officer is at a disadvantage in comparison with an infantry Officer when trying equipment experiments, as the poor animal cannot express its approval or the reverse of the trial, but there is one thing certain that the horse's back will tell no lies, and if the equipment is not a good one the back will precious soon show it.

In a most excellent book called "Manual of Saddles and Sore Backs," Veterinary Captain Smith gives a picture of a horse with a regular tale of horrors in the way of sores on his back, and the poor brute's eye is admirably depicted to show the pain he is suffering; as this book is very widely read, I feel I ought in justice to the British cavalry Officer to say that the causes for the greater number of these sores no longer exist, as they were inherent to a particular saddle, which is also depicted in his plates, but the manufacture of which has long since ceased, and if there are any of these saddles still retained in the Service they should speedily be destroyed, or they will prove disastrous to those who may be doomed to use them on service.

There has been held in London quite recently an exhibition of saddlery at the Saddlers' Hall, where amongst many other articles of saddlery were collected the latest military saddles from eleven European armies; by the courtesy of the Saddlers' Company I was enabled to thoroughly examine them, and also to make drawings of them, which I have enlarged and now produce. To try and make my lecture interesting and possibly instructive, I feel I cannot do better than make a comparison of these different equipments, and to try to draw inferences therefrom. Military saddlery is a subject to which I have given a deal of attention for many years, and, therefore, I hope I may be excused if I am found criticizing occasionally, and frequently giving my opinion; it will be done with the best possible intentions for the good of the cavalry service of all nations.

No nation need certainly be jealous of any one having copied from the other, as I never saw eleven machines all intended for the same purpose so dissimilar one from the other.

The Italian. (No. 1, Plate 28.)

The arches of this saddle are made of wood, and appear very strong; they slope outwards.

The seat is a loose pilch padded in strips; it rests on a strong piece of leather, which is attached to the two arches.

The side-boards are short, like a pack saddle.

There are thickly stuffed pannels, lined with flannel; they are about 1 ft. 9 in. long by 1 ft. deep.

A large thick white blanket is placed under the pannels.

The buckles are galvanized.

The girth is a very broad one, and made of twenty-one thick pieces of cord with three girth-tabs.

The kit is carried in two sheepskin bags, which are hung on each side of the saddle behind; two pockets in each sheepskin.

The saddle has rather a weird appearance, and has what we should call a great fault, in that everything is covered up, and you cannot see anything that may be put on wrong underneath and so be doing damage to the horse's back; the whole is exceedingly cumbersome and weighty, and I should have thought the men would sit very high above their horses, and so have little control over them with the leg, as well as making the whole top-heavy and inclined to roll.

The American. (Nos. 2 and 3, Plate 28.)

The American saddle is, like most other things of this nation's, most original and clever.

The tree is, I presume, a mixture of wood and iron, built up like a plain hunting saddle, but as it is covered over with black leather I could not tell its construction.

The side-boards are short and have a very wide bearing, and are very close together along the backbone.

A large thin grey blanket is used under the side-boards, but I

could not see how it is prevented from slipping if it has a mind to do so.

The girth has the widest bearing on the saddle of any shown; the straps go right over in front and behind the arches, the lower part of girth is very short, and is made of strong dark horse hair twisted up into twenty-four cords between two heavy rings which are fastened with leather thongs to the rings which join the girth-tabs together.

The carbine-bucket is a very short one, with a hole in the bottom of it, and, without seeing how it is carried, it is difficult to understand how the carbine escapes injury.

The stirrup is most peculiar, it is made of wood with a black leather guard in front of it; it is very light, and I am told the use of it is to protect the foot in riding in long grasses.

There is no seat nor are there any flaps in this saddle; it is very light and workmanlike, but I cannot express an opinion as to the comfort or otherwise of riding in it in hot or wet weather.

The Dutch. (No. 4, Plate 28.)

This is a saddle of a very novel and ingenious description. The front arch appears to be flat iron or steel set on edge and sloping back, the rear arch is also of flat iron.

The cantle is long and flat, instead of standing up like most cantles; thus the cloak or kit is strapped on top of it instead of behind it, which insures its being kept off the horse's back, but has the great disadvantage of causing top weight. I should also think that if subjected to rough treatment the cantle would be very liable to be broken off.

The peculiar feature of this saddle is the way in which the side-boards are made adjustable to the shape of the horse's back, being on a hinge with the two arches; the hind arch is continued all the way under the seat to the front arch and the stirrup leather goes round it.

The seat of the saddle looks very comfortable; it is cut in strips and sewn up again, with a second layer of leather underneath treated in a similar way, so as to arrive at the proper shape and make it strong; we might well imitate this seat.

The flap is of a peculiar shape, the lower part of it very far to the front.

The girth comes direct from the front arch and has to be kept back by a strap from behind the flap on the side-board. I cannot think this a good plan, as I should say it would make wrinkles on the girth in a dangerous place, and the lead of the straps does not look right; the girth is of brown canvas.

There is a small bucket which looks as if it was intended to carry the carbine in front of the saddle on the off side.

The wallets are capacious.

Altogether this saddle shows that the Dutch cavalry have been very much alive to the changes of modern times in cavalry equipment, and have profited thereby. There was nothing to show what was

worn between the saddle and the horse. I should like very much to provide them with the numnah and blanket of the equipment I advocate, and another girth attachment.

The Austrian. (Nos. 5, 6, and 7, Plate 28.)

The front and hind arches are made of 3-in. broad, hollowed-out iron, with a long cantle.

The side-boards are roughly made, are short, but appear very strong and of a good shape.

The seat is padded and stuffed, passed over the cantle, and fastened to the front arch; it rests on a strong piece of leather, which is attached to the arches and the side-board by thongs. The flaps are one with seat and appear very broad (18 in.); they are padded in front.

The wallets are very capacious; there are two pockets in them for ammunition, and an attachment which looks as if it was intended for carrying a peg.

The shoe-case is half under the flap.

A small hunting breast-plate.

The blanket is an excellent one; made of white flannel, it is large and thick, and consequently heavy.

There are two girth straps well back on the side-board, and a hard black leather girth.

The peculiarities of this saddle seemed to be the enormous amount of leather in the flap with a stuffed pad in front of it, and the beauty of the thick white blanket, but I could not see how the blanket is prevented from working back. The stirrup-irons appeared to be very heavy; we might with advantage copy the material of the blanket and take a lesson from the side-boards.

French. (No. 8, Plate 28.)

The arches are made of broad flat iron, hollowed, with a thick rim.

The side-boards are wood, and long and broad.

Pannels are attached to the side-boards; they are lined with strong canvas.

The seat appears a comfortable and capacious one, of thick leather, supported by canvas, and fastened with copper rivets to the side-boards.

The wallets are large.

The shoe-case is carried on the off side and is of a peculiarly good shape.

The girth looks an excellent one, composed of six pieces of webbing joined with leather pieces.

The buckles are some of them brass and some galvanized.

There is no numnah or blanket shown, but the French, I know, use a dark-blue blanket.

The pannels and the tree of this saddle appear very heavy, the

seat and flaps are of a good shape, and the shape of the shoe case is well worthy of imitation.

Danish Cavalry. (No. 9, Plate 28.)

This saddle has only one arch, which is in front, and is a small piece of flat iron; it has no side-boards.

The pannels are broad and thick, and lined with canvas.

The seat and flaps are all in one and appeared to be the foundation upon which the whole fabric was built; the seat was joined down the centre, and made of a very thick leather, with a strong ridge behind to keep the man in the saddle.

The wallets are of a medium size.

The saddle bags are of canvas with a leather covering, hung by two straps, one over the seat and one over the hind part of the saddle.

The girth is made of thick webbing with two girth tabs, in which there are eyes, only the strap and buckle being on the girth.

The buckles are black.

There is no blanket, but a very large felt numnah.

This I thought a most peculiar saddle; being without a tree, it certainly adjusts itself to the shape of the horse's back, which is right in theory, but I should have thought it would have been pulled out of shape by the powerful method of girthing up the horse, and the girths, surcingle, and stirrups are all fastened to the flap. The narrow strap for saddle bags across the seat and the ridge behind cannot be conducive to the comfort of the rider.

Danish Artillery. (No. 10, Plate 28.)

The arches of this saddle are of wood, with steel plates let in front and rear, and are consequently very strong.

The side-boards are rather flat, very much turned up in front.

There are no pannels, but a good red blanket.

The girth is a thick leather one, with one large buckle.

The wallets are of a peculiar shape, square at the bottom, with a large cover.

The buckles are all galvanized.

The seat is a sort of pilch, which rests on leather stretched between the arches; the seats and flaps are in one.

There is a very small bucket, which looks as if it was intended for carbine, on the off side, near the wallet.

This saddle appears of a more recent date than the cavalry saddle of the same nation; the tree appears of excellent construction and well worthy of note; the blanket and wallets are good; the girth is peculiar; the seats and flaps cannot be properly judged unless ridden in, they are evidently very light.

Belgian. (No. 11, Plate 28.)

The arches are flat broad iron, rather weak I should have thought.

The side-boards are short, and they have under them thick white numnah pannels.

There is no blanket shown with the kit, but I expect there must be one used. I should be sorry to trust the numnah pannels without one.

The girth is composed of sixteen cords run through strips of raw hide.

The wallets do not look very large; they are covered with a cloth covering, which has the number of the regiment and a crown upon it.

The buckles are some brass and some steel.

The seat looks a very good one, and the flaps of a moderate size.

The saddle bags are capacious, but I should have thought they would have interfered with the movements of the horse from being so far behind.

The cloak is fastened on top of the cantle, which lies flat; this is an excellent plan for keeping everything off the horse's spine, but increases top weight.

This is a very neat looking equipment (bags excepted), the girth appeared an excellent one, and there is a rolled head or heel rope.

German. (No. 12, Plate 28.)

The arches are made of broad iron, hollowed, with a long cantle, and are attached to wooden side-boards.

There are no pannels, but a good big blanket with eight thicknesses. I could see no way for keeping the blanket in its place.

Ths girth is of leather with three long tabs.

The wallets are narrow, but broad on top.

There is a shoe-case with a rope coiled round it.

The seat is a pilch one.

A corn sack is carried behind the saddle, with corn at each end; the cloak is strapped under the cantle. The whole is covered over with a shabraque, which hides everything from view, and must be hot.

The stirrnps have two lance buckets a-piece; it is a cumbersome and heavy equipment, and nothing very worthy of note in it.

The Greek Artillery. (No. 13, Plate 28.)

This saddle has iron arches and wooden side-boards, with black numnah pannels.

There was no blanket shown with the saddle, but the pannels looked as if they would require something between them and the horse.

The girth is of black hard leather.

The wallets are capacious.

The buckles are steel and galvanized.

There is a shoe-case on the off side.

The seat and flaps are all in one, and supported by rather a narrow piece of leather stretched between the arches, which give

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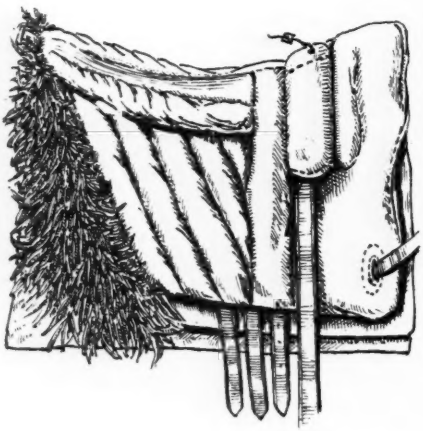

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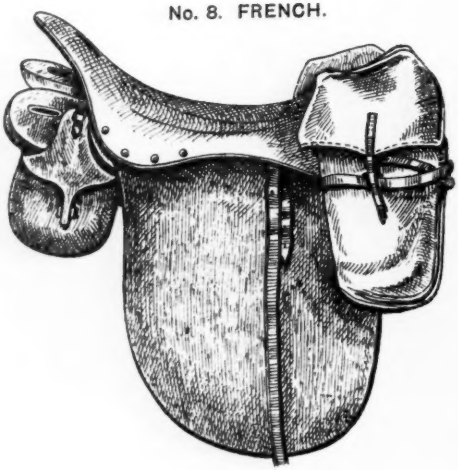

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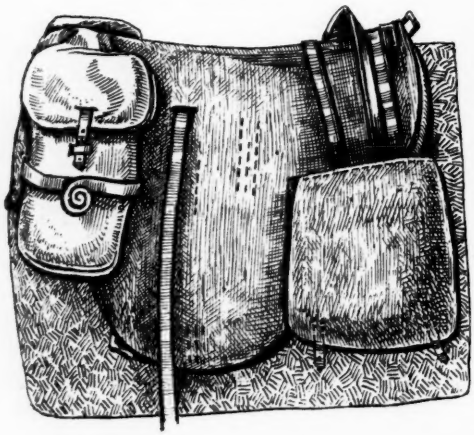

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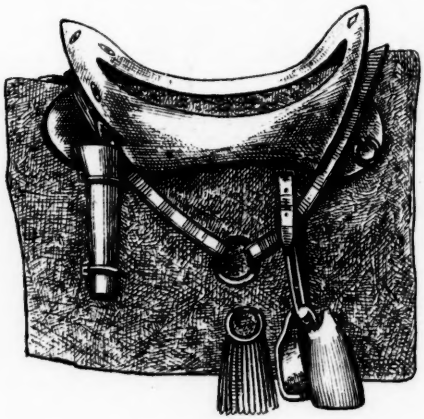

No. 4. DUTCH.

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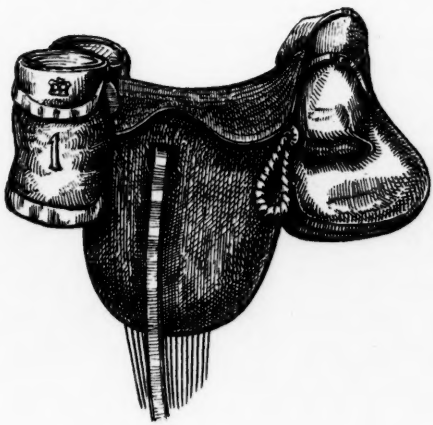
No. 10. DANISH ARTILLERY.

No. 11. BELGIAN.



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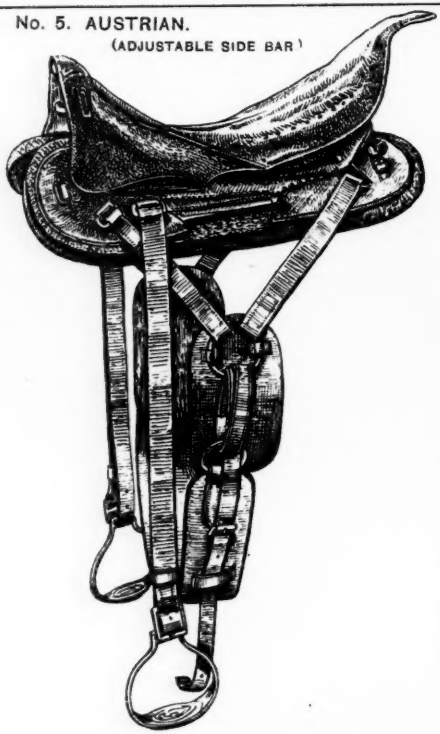
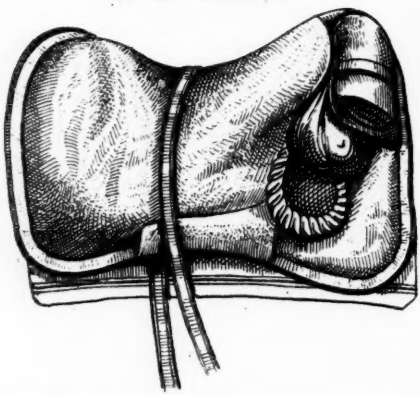
No. 4. DUTCH.

No. 5. AUSTRIAN.
(ADJUSTABLE SIDE BAR)



No. 11. BELGIAN.

No. 12. GERMAN.



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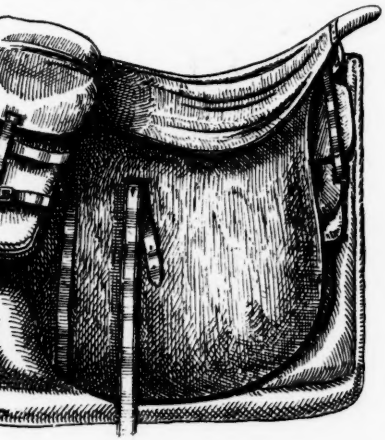
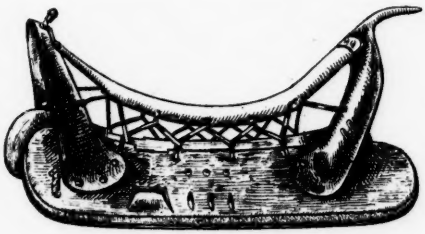
No 6. AUSTRIAN.

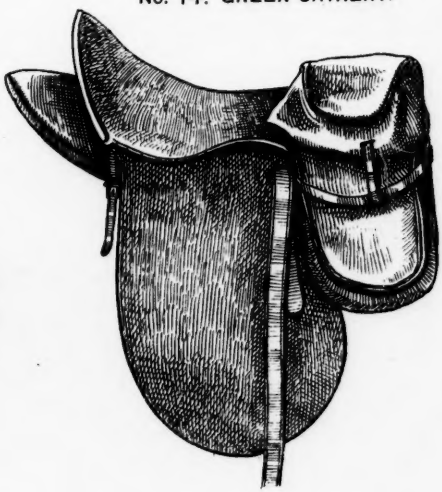


No. 7. AUSTRIAN.
(TREE.)



No. 13. GREEK ARTILLERY.

No. 14. GREEK CAVALRY.



the appearance of a saddle the reverse of comfortable to ride upon; the flaps have a pad in front.

The tree of this saddle seems to be of a modern construction; the stirrup leather passes through the side-board, but not in a way to cause an unevenness.

Greek Cavalry. (No. 14, Plate 28.)

This saddle is of the old post-boy and artillery driver pattern.

The side-boards are wood, with fully stuffed pannels, long in rear but no projection in front.

The girth is a web one like our plain saddles.

The wallets are very capacious.

This is the only saddle apparently which has a crupper, which shows how little that instrument of torture to the horse is now considered necessary.

This seat looks as comfortable as the Greek artillery looks the reverse.

Russian. (No. 1, Plate 29.)

The arches are of round iron, liable, I should have thought, to open; they slope outwards, the side-boards are wood, square behind and short, very much turned up in front, and close together.

There are white numnah pannels on the side-boards.

There is no blanket, but two large pieces of white felt, the upper one is covered with Russia leather.

The girth consists of two pieces of raw hide, very wide apart, with another piece of hide about a foot long to keep the two from separating under the horse; these straps go over the side-boards under the seat.

The wallets are like two little kit bags, with a cord at the top to close them; they are small.

The seat is blocked to fit over the arches, and looks a very comfortable one.

The flaps have a padded front.

The saddle bags are capacious; they hang not across the seat, but over the numnah behind the cantle.

This equipment is the most remarkable one in the Exhibition, and for excellence of work could not be excelled; the whole is made of sweet-smelling Russia leather; the straps are rather delicate, and I cannot think it is exactly the saddle which the Cossacks of the Don use. The horse must be very much covered up by the large pieces of felt, which constitute the numnah and blanket, surmounted as they are by a large piece of Russia leather, which combined reminds one very much of an apparatus used for hot fomentations, but the girth, the seat, and the two layers of felt are well worthy of note and consideration.

British. (Nos. 2, 3, 4, and 5, Plate 29.)

The arches are of steel, with points below their side-board. The side-boards are long and narrow at the end, with a piece of leather round the rear ends to prevent their being chipped.

There are no pannels, but a thin brown blanket is placed between the side-boards and the numnah; the numnah is shaped like the reversible numnah recommended by me, but the straps are so sewn on that it cannot be reversed.

The wallets look small when compared with the other wallets in the Exhibition.

The seat has a division down the centre, something after the principle of the American. I believe this is not approved of.

The girth is a leather one.

The carbine bucket is hung on the off side, and attached to the girth by a strong piece of leather.

The side-boards are made long and narrow for carrying pannels, and it stands to reason that if these latter are discarded the side-boards want alteration.

Turkish Cavalry. (No. 6, Plate 29.)

Turkey has sent, since the Exhibition of Saddlery was closed, most complete sets of cavalry and artillery saddlery.

The arches of cavalry saddles are hollowed-out iron, very broad, a high front arch, and a long cantle.

The side-boards are wood, same breadth all along, and short; they carry pannels, beautifully stuffed, of the same shape as the side-boards.

The stirrup leather goes through the centre of the side-board, in a very bad place. It would be very well for Turkey if they took a hint from the Austrian side-board, of the best way for the stirrup leather to hang; the leather is under the flaps.

The wallets are large, but lie very flat; they are about half the thickness of our own; in the near one there are two pockets for ammunition; in the off one a place for shoes. The seat is a loose pilch, and great trouble is taken to make it soft; there is a broad piece of leather stretched under the seat.

The girth is a web one, with three straps.

The shoe-case is a very good one, like the French, and on it is rolled a rope.

There is a little shabraque, which is lined with felt.

The artillery saddle has same description of arches and side-boards, but a large blanket, 8 ft. by 6 ft., instead of pannels.

The shoe-case is like the British.

The girth is leather, with one large buckle.

The whole kit is very complete; collars seem very well stuffed.

Cow-boy. (No. 7, Plate 29.)

The arches of this saddle are made of wood, covered with raw hide side-boards ditto, which make it very strong.

The girth is in two pieces, one in front, and the other behind, the saddle, and can be joined under the belly; the stirrup is very far back, and goes over the seat. The flap is attached to the stirrup leather.

There is a sheepskin bag behind, like the Italian, for carrying kit.

Under the pannel is a leather, lined with felt, on which the saddle rests.

There is a red blanket next to the horse.

The two girths are of strong cords under the horse.

This saddle is very strong, as can be seen any day at the Wild West show. They say it seldom breaks, and it gets very rough work. The front girth is the main one, and is very far forward; it can be tightened to any extent by the long leather strap which passes between the two rings. From the girth being so far forward, it is kept tight by the weight of man in the saddle acting as a lever against it. It is very remarkable how these saddles cling to the back. A man can drag himself from under the horse's belly up into the seat without moving the saddle. They have no points; they say the blankets do not slip back, and that the saddles never gall the horse.

The flap being attached to the stirrup leather appears a very sensible plan, as it requires only a small piece of leather, and it is always where it is wanted; whereas with a large flap a great deal of it is never used, and it tends to make the horse hot, besides being heavy and expensive.

Crichton. (No. 8, Plate 29.)

The arches are made of steel; there are no points below the side-board.

The side-boards are broader than the British, and the ends are not so pointed.

There are no pannels, but a blue blanket, about 6 ft. square, is carried between the sideboards and numnah.

The numnah is so shaped that it can be reversed and used either side to the horse, or either end to the front, and there is a strap at each end to attach it to the front and hind arches of the saddle.

The wallets have tins inside them which keep them in good shape, and enable the cloak to be tightly strapped to them, whether they are full or empty.

The buckles are all brass.

The seat is rather longer than the British, and supported by welting.

The stirrup leathers are passed through a bar on the side-board, and not through the side-board itself.

The girth is a leather one, cut in strips on each side.

The carbine bucket is like the British.

Now I will endeavour to compare all the foregoing saddles, and see how far different nations are agreed, and how far they are at variance, and when I express opinions on their suitability, or otherwise, I do so simply from observation, and therefore am very subject to correction, as I always hold two things about saddlery, that no opinion is worth a rap unless formed after personally trying the equipment by riding in it a great many miles, and seeing it tried on a number of horses for a period of a year or two by different corps. I have had no opportunity of trying any of the saddles except my own, nor do I know how far any of them have been tried, except the British, and some of them look to be of a very novel construction.

On the question of the material of the arches of the saddle, out of 13 shown I find 5 wood and 7 iron, and 1 no arch at all to speak of, viz., the Danish.

There are a variety of iron arches, broad, flat, and curved with a strong rim like the French, Austrian, Dutch, Belgian, Hungarian, and Greek artillery are the most common; the round iron, like the Russian, and the angle steel, of which the British are made; of these I should say decidedly that our latest steel arches are the strongest. Iron is always liable to open, if not by use by a sudden blow, or horse rolling upon it. This may be said of a wooden arch, with regard to violence, as the latter, when combined with iron plates, may be smashed, but will never open, and if smashed up it cannot help being noticed, whereas iron arches may be opened by a blow, or gradually opened by pressure, and the horses gradually suffer from a badly-fitting saddle; and if one opens from pressure, the probability is all of the same pattern will do so, without any possibility of cure, as when iron is closed by force it will open again all the more easily when pressure is applied.

The wooden arches are favoured by Italian, American, Danish artillery, and Greek cavalry; of these the Italian and Danish artillery seem very strong; the American and Greek, being covered up with leather, I could not judge of; the Danish artillery struck me as being the best one in the Exhibition, with a broad and long piece of steel on edge let into the wood, it would take a tremendous blow to smash it, and it could not open.

Points.

We have always had in our English saddles certain things called points, which are the continuation of the front arch below the sideboards; these, as a rule, bear either too hard or not at all; in the former case they utterly upset the balance of the saddle and hurt the horse, in the latter they are useless. In saddles of my own pattern I have lately done without them with beneficial results, and I do not find a single saddle of the thirteen, except the British, which has points.

Side-boards.

The side-boards are almost the most important part of the saddle, as they are the medium for conveying the whole weight of saddle, and whatever is carried upon it, to the horse's back. The following have a short sideboard: Italian, American, Dutch, Austrian, Belgian, Danish, Greek artillery, and Russian; the British, French, and Greek have a long one. The disadvantages of side-boards being long behind are that the further back pressure is placed on the horse's back the more the friction, owing to the movement of the hind quarters, and the longer the saddle the greater will be its movement at its extremities.

The advantages of having a long side-board are that it enables the kit or cloak when placed behind to be better carried than on the short one, and therefore I consider the best saddle is the one with a long side-board, so arranged that the last 3 or 4 inches of it can carry the kit but not touch the back; this can best be done by the blanket being folded of a certain length and carried between the numnah and saddle, and this arrangement I have found to answer admirably. Now I wish to draw special attention to the side-boards of the Dutch saddle, which reminds me that the Dutch have considerable experience in side-boards of another description, viz., on their boats, which may possibly have specially directed their attention to the subject; these are intended in a very simple way to adjust themselves to the shape of the back, but I hold that their doing so leads to another danger, as it cannot be expected that a horse will lose or gain muscle in the same degree all over the back, and suppose the back alters shape under the seat of the saddle where the greatest weight is, the board would adjust itself accordingly, which action of it might bring the edge of the board in front in contact with the side of the withers where the horse might have altered shape in a converse way to the back. For this reason I must here mention a saddle which was shown at the Exhibition by the gallant Officer, our Inspector-General of Cavalry, who has done me the honour of taking the chair at this lecture, which saddle obviates this objection, as the front part can be adjusted in one direction and the rear in another; this is excellent in theory, but what it would be in practice I cannot say, but I hear of a very successful trial of thirty of them by the 7th Dragoons in Austria. I should be a little afraid of uneven pressure in them on account of the breadth of the hinges. What, I think, is of the greatest importance in the fit of a side-board is the curve in its length more than in its breadth, as horses differ almost more in that way than the other, and the amount of weight at the moment it is placed on their backs will increase the hollow, as well as age. I should therefore like to see a side-board which would adjust itself to the hollow of the back as well as the other way. I have heard of a steel (board I cannot now call it) bar performing these functions, and I should be very glad to hear more of it. If a side-board is too straight it rests on its two ends, and if it is too curved it rests on a small piece in the centre.

This of course can be met by clever and careful folding of the

blanket so as to make up the deficiency, but a good fitting side-board is the foundation of successful saddlery, and the best one can do now is to get a side-board shaped in a medium way which will be most likely to fit best the greatest number of horses.

Pannels.

Of the saddles in the Exhibition I find only three have pannels, viz., the French, Danish, and Greek cavalry.

I know that pannels have some very strong advocates, and they may be very well when there is a saddler close at hand to teaze and arrange the stuffing exactly where wanted; but stuffing is very contrary, and will not always stop where it is wanted, and in a strong regiment, moving, perhaps, every day, pannels get hard and lumpy, and there is not time to teaze and arrange them, no matter how efficient the saddler sergeant and his assistants may be; it is a long business arranging the stuffing of a saddle, and also when a regiment is much scattered it is impossible to send a saddler with every party.

The plan of chambering a pannel, that is, taking all the stuffing away from one particular spot, where the horse's back is sore, may sometimes answer very well, but it is a dangerous experiment, as no one can depend upon a saddle remaining in exactly the same place on a horse up hill and down hill and on the level, and if the edge of the chamber gets on the sore, the remedy intensifies the malady in a very short space of time; when the hole is made large enough to prevent any possibility of the sore being touched, the extent of the bearing is so much reduced that another part, where the bearing becomes excessive, will probably suffer. The best and surest remedy, I believe, is to have the horse that is touched in the back led for a day or two without a saddle, and the man mounted on a sick man's horse, or go as baggage guard. I am not an advocate, when the skin is really broken, of tinkering with the back, either with a pannel or a blanket, as the least friction then delays the cure; lumps and swellings may be overcome by arrangement of saddlery, but when the blood appears it is time for the veterinary art to step in and give the part rest. I must say I think the majority of foreign nations are right in discarding pannels and adopting

The Blanket.

Of the 14 saddles under discussion, 3 have pannels, 7 blankets, 2 numnah pannels, 1 side-board only, Dutch; 1 double layers of felt, Russian. I should say that the two with numnah pannels, viz., Greek artillery and Belgian, must use blankets as well, and the Dutch must have something under the side-boards, which would probably be a blanket, and, if so, the numbers would mount up to 3 pannels, 10 blankets, 1 numnah layer. I will state what I have, from long trial, gathered to be the advantage of the blanket over the pannel.

1. It answers the double purpose of covering the horse as well as a protection of the back; the pannel does the latter only.

2. It saves the expense of pannels, as a horse blanket must be carried, either on or off the horse, though pannels are used.

3. If the horse blanket is carried on the horse, as well as the pannels being used, as in the Italian equipment, the weight is doubled unnecessarily by pannels.

4. The blanket does not move with every movement of the saddle, as the pannel does, and so scrape the surface; there is, I believe, less movement in every fold, as it gets nearer the back; this would appear a theory, but I have derived it from the observation of horses which came in sweating after work. When ridden with pannels the shape of pannel is observed on the back, whereas when ridden with side-boards and blanket, you cannot discern the shape of the side-boards on the horse. Again, the hair on the back of a horse ridden much with pannels, and where the pressure is uneven, will become closely shaven, as if with a razor, and sometimes bare of hair altogether; although in neither case actually sore, it is liable to be so; this will never occur on backs ridden with blanket.

5. Every time the blanket is unfolded and refolded it is to the saddle what teazing pannels would be, it becomes quite soft, and the bearings are not in precisely the same way as before; to put it in another way, it must feel to the horse what it is to an invalid with a weary back when his bed is made afresh; and when it is considered that this can be done in a few moments in the middle of a long march no one can but allow that it is of inestimable value.

I may be told that there is danger in doing this for fear of not putting it properly together again; there may, of course, be isolated cases of such occurring, but the general good derived would far outbalance any such. During the late mobilization manœuvres at Portsmouth, the horses of the Yeomanry regiment which I command had to do exceptionally hard work, owing to having to perform troop and regimental drills as well as night and day attacks in connection with the mobilization, and I attribute the good state of these horses' backs, to which Veterinary Captain Smith can testify, to the way the blankets were being constantly shaken out and refolded, and the numnahs reversed.

On one occasion, when out at regimental drill, all the saddles were taken off the horses, every strap and buckle undone, cloaks unrolled, numnahs and blankets detached from saddle and shaken out, and then, for regimental competition for the best turned-out troop, they were put together again by the yeomen themselves on the field, the regiment proceeding as soon as mounted straight to a divisional reconnoitring field day for four or five hours without any casualty occurring.

This, of course, was a much higher test than I advocated when suggesting the advantages of shaking out the blanket only, but I instanced it to show how a much more difficult performance could be got through without harm resulting.

Now, as to the best way of folding a blanket, the best plan is that which is easiest: I have found the plan of folding a blanket 6 ft. square in three equal parts, double it, and then place on numnah,

the best. It can be easiest done by one man, which I will practically illustrate, and, if thus folded, placed on the numnah, the straps of which are buckled up to front and rear of saddle, it is a total impossibility for it to shift or work out behind. The blankets in our cavalry service are, I think, folded differently, so as to have more folds on the side-boards than on the back; this is right in theory, but in practice I notice the extra thickness is inclined to slip down, and so make a ridge under the side-board.

I cannot see how the blankets shown with the foreign saddles are kept in their places. I may be told they never shift, but, on the other hand, I have been told they often shift. The tendency of a blanket when put next to the horse's skin is always to work back, the reason, I believe, being that the lie of the horse's hair is from front to rear, and so causes the blanket to move, on the same principle that an ear of barley will creep up your arm if you put it inside your shirt, but anybody who does not believe me can try the experiment by placing an ordinary blanket on a horse's back and an ordinary plain saddle on it, when, after riding for some time, he will find the blanket gradually disappearing from in front and coming out behind. I know the plan alluded to in the book "Saddles and Sore Backs" of turning back the front bottom corner; this may do very well when the girths are tight, but when they get slack away will go the blanket. I believe the only sure and best plan in every way is not to place the blanket next to the horse, and so keep it out of temptation's way, but between the numnah and the saddle; I have done this, with great success, for the last nine years in my Yeomanry, and our cavalry have adopted it for the last few years.

A blanket is hot on the horse when close to the spine, but with a numnah buckled up in front and rear of the saddle and well hollowed out along the top, there is a channel of air the whole way down the back, and when the horse comes in from work, the spine will be found to be perfectly cool, no matter how the part under the side-boards and flap may be sweating.

If a blanket gets mud or gravel into it, a few shakes when folding will soon get rid of it, and stones naturally tumble out, and if the blanket is wet it will be a little heavier, certainly, but soon dries from the warmth of the horse, and as far as padding goes it is none the worse for being damp.

The following are the sizes and weights of the blankets:—

Austrian.....	9 ft. by 5 ft.	10 lbs.
Danish.....	7 „ „ 6 „	5½ „
British.....	6 „ „ 5 „	5 „
American	8 „ „ 6 „	4 „
Italian.....	6 „ „ 5 „	3¾ „

Numnah Pannels.

Now I turn to a third means of softening and correcting the fit of a side-board, viz., numnah pannels; these we find in the Belgian and Greek artillery saddles, and they have been tried in our Service too.

I look upon them as unnecessary if you have a stout, thick, serviceable blanket and a good numnah; they may stretch, though their advocates will stoutly deny this, and they, of course, increase weight and expense, and I should not like to trust them alone without a blanket.

Numnah.

The numnah is a rarity in foreign saddlery, appearing only in the Danish, and there in a very exaggerated form; in the Russian it appears in a two-fold form, and there, also, I venture to think they have more of it than necessary.

We have in our Service used the numnah for a long time with very tolerable success, its worst feature being that where much pressure comes constantly in one place it gets greasy and hard; to clean it, the soldier uses his own nails or the curry comb and so destroys the surface and a roughness or hole comes which renders it worse than useless. To obviate this I invented a reversible numnah, so cut that it can be used either side next to the horse or either end to the front; thus there are four ways of wearing it, all equally the same, and if shifted every day it would never get into grease spots; this I have tried now for over eight years with great success; our saddlery equipment authorities adopted the shape, but have sewn the straps on in such a way that the numnah can only be worn one way, thereby entirely frustrating the object and consequently the benefit; the reason being given that the numnah was liable to be torn near the straps. This has always been a possibility with the Government as well as my numnahs, but I have now had the straps sewn on to the felt and the felt itself sewn in a way which will render it untearable even to the strongest dragoon, who will put his whole strength into it with the laudable desire of getting the numnah tightly strapped up into the fork of the saddle. This numnah is fastened in front by the above-mentioned strap over the front arch to a buckle on the saddle, and behind by a similar strap to another buckle attached to the cantle. This ensures the free passage of air between the back and the numnah, and prevents the possibility of the blanket, which is between the numnah and the saddle, shifting back.

Girths.

There is a great and interesting variety in girths. Six saddles have the leather girth, some of which are as hard as a board, 2 have a web girth like plain saddles, 1 has a brown canvas girth, 2 have strong girths, and 1, the Russian, has the most remarkable, viz., two pieces of raw hide about a foot apart, the American a horse-hair girth, and the French a number of pieces of broad webbing.

A good saddle which will stop in its place is not so dependable upon a girth as a bad one; of course plain leather is durable, but it gets precious hard, when it becomes liable to crack. I am inclined to favour the principle of the Russian two raw hide thongs far apart over the tree as well as under the belly. It certainly is most uncommon,

and appears to carry out the principle of wide bearings to a greater extent than any of the others do; this principle is found in the cow-boy saddle. The American horse-hair is bound to be a good one.

Breast-plate and Crupper.

There is nothing very remarkable in the way of breast-plates except in several instances their absence; where they existed they appeared to be more for ornament than for use, but I do not think it would do for our cavalry to give up their use, as the country over which they are employed at home and abroad embraces many a steep hill where a breast-plate would be found necessary, I could only find one saddle with a crupper, viz., the Greek cavalry, which shows there is a strong feeling against that instrument of torture which, whenever it came into play, used to gall the tail. A saddle can go over the tail, but cannot possibly pass over the head, which argues that the retention of a breast-plate is more necessary than that of a crupper.

Wallets.

In twelve out of fourteen saddles under discussion there are wallets; the foreign wallets appeared to be all more capacious than the British, except the Russian, which looked like small kit bags.

The Americans and Italians do not appear to use wallets.

One thing I remarked about the foreign wallets was that they all have a buckle and strap to fasten the cover instead of the stud and hole which, when a wallet is packed full, has broken the nail of many a British dragoon in his endeavours to fasten it. I recommend this to notice.

Buckles.

I noticed that nearly all the buckles were either galvanized, black, or brass. We have always had steel buckles in our Service, Life Guards, I believe, excepted. I used brass buckles in my equipment for Yeomanry, and find them serviceable, smart-looking, and easy to clean. I am happy to see they have been introduced into the latest pattern Woolwich saddle, and I hope they may be continued.

Shoe Cases.

Shoe-cases are few in the saddles shown. The Austrians carry one, half under the flap of the saddle; the French, as I remarked, carry one of a very good shape, and, I think, the Hungarians carry one, but these beside the British were all I could see.

Seat.

Now respecting seats of saddles, this is a very important subject for the man's back as well as for the horse's back.

For the man because a bad seat wearies him out, and renders him useless for all his duties after coming in, for the horse, because it so

much depends upon the way he sits in the saddle whether the greater weight, the man, is evenly distributed on the side-boards.

For choice, I should say to look at, the old Greek post-boy saddle, and the Dutch and French were amongst the most comfortable to sit in, and there were several which looked most uncomfortable.

The majority appear to favour the long cantle behind the saddle; this I have often heard severely criticized by men who do not belong to the mounted branches, and I was very pleased to see that the long cantle was so much favoured by Continental armies. I look upon it as essential, for the following reasons: it assists a man materially in mounting; it is the only possible safe way of keeping whatever is carried behind the saddle off the horse's back, and it helps to keep a man in his saddle in hand-to-hand encounters.

I watched a regiment for some years doing the annual sword competitions, and there were a mixture in the regiment of the wooden-arched saddles with the high cantle, and the iron-arched saddles without any cantle, and I invariably noticed that the man in the former saddle had an advantage over a man in the latter. When it came to a collision, or the horse reared or plunged, or a very rough thrust was made, I have seen a man driven over the hind part of his saddle and succumb over the horse's tail out of a low backed saddle, whereas, under similar circumstances in the high cantled saddle, he would keep his seat. It was very noticeable that when a man was unseated, it was almost invariably out of the saddle without the cantle.

It is difficult to compare the length of seats, as with the high peaks it is not easy to say where the seat begins and where it ends, but the usual lengths from the front of saddles to the hole in the cantle varied between 17 and 18 inches. The length of a saddle must be determined to a certain extent by the way the men are ordered to ride, as if they ride with short stirrups, the seat should be longer than if they ride on their forks with longer stirrups. The danger of a long-seated saddle is that when tired the men will lounge back in their saddles, and so bring all the weight in one place, viz., where the side-board begins to curve up under the hind arch, but in a short seat, the men must sit up.

I noticed that a good many of the saddles had a strong piece of leather stretched from the front to hind arch, to support the seat; this was fastened in most cases by thongs to the side-boards; it seemed in some to make rather a ridge down the centre of the seat, which is very uncomfortable. I decidedly admired the Dutch seat, which appeared to be made of double strips of leather sewn together. The American, of course, was the simplest, as there was little or no seat at all.

Flaps.

Five of the saddles had the flaps and seats combined in one; three saddles had stuffed pads in front, which I should have thought were unnecessary; two had a great amount of leather, viz., the Austrian and Greek artillery; the American none at all; and the Dutch a

very peculiar flap, much broader at the lower part than the top. I certainly think that for comfort and utility saddles like the French, British, and Belgian seemed the best, as far as the flaps were concerned.

Stirrups.

Some of the stirrups looked very heavy, noticeably the Austrian and Greek, but they evidently laid great stress on roughing their stirrups to prevent the foot slipping. The American I have already described.

Saddle Bags.

Five of the saddles carried saddle bags; this, of course, is a very convenient and commodious way of carrying kit, but a Veterinary Surgeon will tell you that, owing to the configuration of the ribs of the horse, weight should not be carried on the place where these bags are always hung; they are certain to make horses sweat a good deal, and they get knocked about very much with close work in the ranks. They may be all very well for a pack horse, which goes along by itself, or in a string at a slow pace; but I should not choose them for cavalry, who have to ride close, and do sharp work.

Carbine Bucket.

It was difficult to discover from the equipments how the carbine was carried, and only in four saddles could I see any rest for it on the saddle, which leads me to suppose that the majority of the foreign cavalry carry the weapon entirely on their back.

In the British it is carried in a long bucket; in the American, in a very short one, both behind the leg; but in the Dutch and Danish, in a very small bucket, in which only the muzzle fits, in front of the leg; this is the way our cavalry carried it about twenty-five years ago, the best illustration of which I have seen in an electioneering squib, in which Lord Salisbury, dressed as a dragoon, is settling his chief political opponent.

As far as the horse is concerned, the best place for the carbine is on the man's back, as it saves the weight of any equipment required to carry it, and the consequent chance of damage to the horse from it; it also prevents the upsetting of the balance of the saddle when the carbine is carried entirely on one side, but it must weary the man very much and interfere with his skill as a swordsman.

Our gallant Chairman is now experimenting on this subject, and has, no doubt, hit on the right principles, viz., that the weight should be divided between the man and the horse, and that the carbine should be so attached to the man that when he is parted from his horse he should not also lose his carbine; this, since the sword has been carried on the saddle, has become all the more necessary, and I trust he will be successful in achieving so desirable an object.

Weights.

The comparison of weights of the various saddles is a very difficult one, as they carried a great variety of equipment, but I made the following comparisons:—

Italian. Saddle, breastplate, girth, sheepskin, stirrups ..	31 lbs.
American. Saddle, carbine bucket, girth, surcingle, stirrups.....	20½
Dutch. Saddle, breastplate, girth, carbine, bucket, wallets, stirrups, straps	25 „
Austrian. Saddle, wallets, girth, surcingle, stirrups, straps, shoe case	30 „
French. Saddle, girth, wallets, stirrup, breastplate, shoe case	30 „
Danish cavalry. Saddle, girth, wallets, surcingle, stirrups	27¼ „
Danish artillery. Saddle, seat, girth, breastplate, stirrups, wallets, strap, carbine bucket.....	18¾ „
Belgian. This equipment being fully packed, I did not weigh it, as it could not thus be compared to the others.	
German.....	32½ „
Greek artillery. Saddle, wallets, shoe case, breastplate, girth, stirrups.....	28 „
Greek cavalry. Not weighed.	
Russian. I had not weights enough for this equipment.	
British. Saddle, carbine bucket, wallets, girth, surcingle, shoe case	27 „

From the above weights the Danish artillery would appear to be a very light one, and it certainly has a very strong, if not the strongest, tree shown. It beats even the American in lightness, which has so little on it.

It is of course most desirable that a horse should carry as little as possible; upon that every one is agreed; but, to stand the rough work to which a cavalry saddle must be subjected, it is necessary it should be of strong construction; this means weight. Again, to keep the man in health, to enable him to look after his horse properly, it is also necessary that he should not be separated from a change of clothing and a waterproof sheet, and that he should carry a few articles for looking after his horse and equipment. This also means weight, and must be taken into consideration when trying to reduce weight; without the above necessaries the horse will probably suffer more than he would from the extra weight which they entail.

Story of the Saddles.

I find the story of the saddles in England since 1855 is shortly this:—

Commencing with the Nolan pattern wooden arch, a Committee

recommended total abolition of blanket and substitution of pannels; this was, I believe, mainly because the blanket would slip back.

There being complaints of leather seats in India breaking away from the wood, the Principal Superintendent of Stores at Woolwich introduced in 1868 a saddle of which the seat was strapped round the arches instead of riveted, and substituted iron instead of wood arches, which saved cost in manufacture. These were found to be miserably weak, and had to be strengthened from time to time by various patterns, each one costing more than its predecessor, until we have arrived at a tree which costs more than double the original one, which was discarded partly on account of expense. The following are the prices of the tree without leather work:—Nolan, 1855, 14*s.*; iron arch, 1868, 12*s.* 6*d.*; steel, 1890, 30*s.*; and the price, I believe, is still rising. It is for this reason that I recommend the trial of a tree like the Danish; wood is lighter, cheaper, easier to repair, and stronger than iron; there is lots of beech to be had in England, and if there was a demand for it, it would be kept the necessary time before being used. During the Franco-German war the French suddenly wanted a lot of saddles, and came to England for them; we had been making our saddles of iron, and had no seasoned beech; therefore they had to be made of elm, and were not a success.

I consider we are deeply indebted to Continental military authorities who have been so good as to contribute to such a valuable collection of saddlery as was shown at the Saddlers' Hall. I trust they will gain more by being able to take hints from other countries than they lose by having their own good points copied. To look upon it from a humanitarian point of view, that noble animal, the horse, cannot, I hope, fail to benefit, not only in having his burden lightened, but in having what he is obliged to carry placed on the back in the position most comfortable for him to bear it.

The British Army are also indebted to the Saddlers' Company, who have with such open-handed generosity given them and the public at large the opportunity of seeing all the foreign equipments and comparing them with their own, and I trust that much advantage will accrue from that comparison.

But we should not bolster ourselves up with the idea that everything English is the best, and that nothing is to be gained from the experience of others. To sum up, after a careful inspection of the foreign saddlery, I have come to the conclusion that in the way of arches, side-boards, and seats we have much to learn, and though strongly holding to the method I have advocated of carrying the blanket between a reversible numnah and the saddle (whatever it may be), I am inclined to think we are on the wrong tack still as regards the framework of our saddles, which are expensive and difficult to make, and I should much like to see a combination tried of the best parts of the various equipments, such as arches and side-boards of the Danish artillery, seat of the Dutch, side-boards of the Austrian, and I therefore take this opportunity of entreating our War Office authorities to make an endeavour, through the Foreign Office, to retain in England this valuable collection of saddles, where

they can be seen not only by our own Army, but by representatives of other armies, to the mutual benefit of all concerned.

The End.

Great efforts have been made of late in all our Departments, whether Saddlery, Veterinary, or Regimental, to arrive at a good saddle, and to make it an efficient one, until, I believe, the authorities at the Horse Guards have quite lost patience with the Cavalry Service, and are inclined to fix on any pattern, and order it to be made by the thousand; but we do not, from the Exhibition at the Saddlers' Hall, appear to be the only nation who are trying to improve themselves in this respect, so I trust that after this most important Exhibition a pause may be made to consider whether we are wise or not in the line of saddlery which we are at present pursuing, as now is a very critical time. I cannot find that there is any regulation British pattern at present approved, as I understand there is another even later than the 1890 pattern about to be issued for trial. Gentlemen, the subject which I have had to deal with is a very interesting one to cavalry Officers, and a most important one to the whole Army. Cavalry still are the eyes and ears of an army, and to enable them to perform their duties it is above all things necessary that they should have the very best saddlery equipment which can be provided for them, and I shall feel very proud if any remarks which I have made in drawing attention to the merits and demerits of our neighbours' will lead us in that direction.

The CHAIRMAN: We must all agree that Colonel Crichton was right in saying that this is a subject of the utmost importance to the cavalry. I do not think anyone could have done it more justice than the lecturer. The interest taken in the subject is shown by the presence of so many cavalry Officers, some unfortunately now lost to the Service, men who have studied it equally with Colonel Crichton. I also see some gentlemen present who are experts in saddlery, and who have made the theory of building saddles the subject of their life study. I hope we shall hear some remarks from them, and also from gentlemen in the Veterinary Department of the Service, if they will be good enough to give us their opinions with regard to what has been said.

Major PHILPOTTS, R.A.: I want, with your permission, to say a few words with regard to the Hungarian saddle. It was a saddle sent to the Exhibition from the Royal Artillery Institution at Woolwich. It belonged to the 2nd Guard Uhlan German Cavalry. They call it the Hungarian pattern, but it is not really the Hungarian saddle, it is the German saddle. The seat, instead of being made of raw hide, like the Austrian, is made of ordinary brown leather. It has side bars like the Turkish, and in a great many points it resembles the Turkish saddle. As the lecturer has said, the shoe-pocket is a very excellent arrangement. It is fixed on a vertical slot in the upper part of the shoe-pocket which slips over the D on the tree, and is kept in its place by means of the near-side baggage strap. The cloak is not fixed in the same way that ours is fixed, but with the three baggage straps in rear of the saddle. There is an arrangement for carrying corn—a bag laid across in rear under the cloak. On the near-side stirrup-iron there are two buckets for lances, one on the off side, for dismounted work. The saddle may look heavy, but is not really so, and in use will be found thoroughly workmanlike. The side bar measures 5 inches by 21. The blanket seems most excellent. It is not quite as thick as the Austrian, but is of excellent material, better than our present Government brown blanket; it is much thicker and will wear much better. It is kept in its place by

the front corners being turned over and fastened by means of the girth straps. I believe they do find that it sometimes slips. It measures 7 feet by 7 feet 11 inches, whereas our blanket measures only 5 feet 6 inches by 4 feet 10 inches. It would be most useful for the horse on the picket lines. Our blanket very soon gets worn out, and would not, I fancy, be of much use on a wet night. The pilch is something between the Turkish and the Italian. The stirrup irons certainly look heavy, but they are very similar to our new pattern. The weight of the saddle with one shoe-case, breast-plate, girth, wallets, and surcingle, is 32 lbs. It has one shoe-case on the near side, and on the wallet, on the off side, there is a place for another shoe.

Colonel E. A. WOOD: I only want to make one remark connected with the American saddle. I had a Whitman saddle sent over for me to try in the 10th Hussars in 1884–85. I gave it a thorough trial and was very much gratified with it. There is one point that does not appear in the drawing, namely, that the saddle was supplied with the horse-hair numnah. There was with it a small, square, horse-hair numnah which fitted between the blanket and the saddle. Although there was no breast-plate or crupper, the blanket never moved an inch, and I believe that was simply because it was a horse-hair numnah. I tried afterwards to get the same numnah at the Horse Guards, but I found it was lost. I believe that to be a most important point. The Americans evidently find some advantage in it or they would not use it under the blanket.

Lieutenant-Colonel HUTTON (Commanding Mounted Infantry): Perhaps, first of all, an apology is due from me for taking up this question at all, seeing that I am not a cavalry Officer. I have, however, gone very carefully into the question of saddles for a number of years past. In fact, I went over to America some years ago for the purpose of studying questions in connection with mounted troops and the Whitman saddle, and the American saddle equipment in particular. The whole question of military saddlery must turn upon the weight to be carried on the saddle. I think, before considering the question of military saddles, we should consider really what weight the saddle is to be required to carry. Many foreign nations have adopted saddle bags, whereas this country and several others have retained the old method of carrying the kit and other *impedimenta* upon the top of a heavy saddle or superstructure raised above the horse's back. The first consideration is the weight to be carried on the saddle, and the second, the position in which that weight should be placed. First, as regards the weight. It has been laid own by Professor Smith and other authorities that the weight to be carried should not exceed something between one-fifth and one-sixth of the weight of the horse itself. In the case of an English troop-horse, which weighs about 1,000 lbs., the weight would be about 15 stone. In the case of smaller horses, of which I have personally had considerable experience in different parts of the world, weighing from 800 to 900 lbs., the weight should be from 13 to 14 stone. The weight of the saddle, which Colonel Crichton has given as the English saddle, is stated to be 27 lbs. No authority for this statement is given, and in the only tables we have to go upon of an official kind, published with the Army Orders of 1888, the weight of the regulation saddle is put down at 3 st. 5 lbs. or 47 lbs. By the Cavalry Transport Regulations, the English cavalry soldier rides from 18½ to 22 stone, or from 3 to 4 stone above what any horse should be called upon to carry. The same relative weight by regulation holds good for mounted infantry, who, by regulation, is to ride 19½ stone, or from 6 to 7 stone above what any small horse (Arab, Cape, American, or Irish cob) can carry. Are we, gentlemen, in the future to overweight our horses in this absurd manner? If, as common sense dictates, the weight of a cavalry soldier is to be reduced to 15 or 16 stone by relegating all superfluous kit and paraphernalia to the baggage wagon or pack-horse, surely it will be unnecessary then to place 47 lbs. of saddle and saddle equipment on the horse's back. Secondly, as regards the position of the weight on the horse's back, I know that most authorities agree on the necessity of the man's body and all dead weight being brought as low upon the horse as possible. This object is best met by the American saddle, an adaptation to which has been proposed by myself and strongly advocated by several Officers high in authority, the weight of the man's body is, with this saddle, actually upon the horse itself, and is not raised upon a tree or super-

structure as in the case of most other military saddles. Oscillation is obviated by this means, and a much lighter saddle can be used, which, however, should, of necessity, have a saddle bag to carry any extra kit or *impedimenta*. I know of no description of military saddle which better meets the necessity of lightness, cheapness, and durability than the American saddle. The lecturer alluded to the wooden tree of the American pattern saddle and to the possibility of its being broken or getting out of order. This is, no doubt, a difficulty; but the Whitman Company, who make for the American Government, shrink hide over the whole wooden tree, and that to a very large extent strengthens it. The lecturer also referred to the material for making trees, viz., wood or iron. To a great extent the material depends upon the climate in which the saddle is going to be used. If it is to be used in a country where there are great changes of temperature, the iron tree is not advisable, because the changes of excessive heat and cold cause the metal to expand and contract, and that is one reason why the Americans have adopted wooden trees. With reference to the Belgian saddle, which Colonel Crichton has specially brought to our notice. It is worthy of remark that the Belgian soldier rides from 14½ to 15 stone, and that he is the lightest equipped cavalry soldier in Europe. Colonel Crichton referred also to the length of the side-bar. The length of the side-bar must depend entirely on the length of the back of the horse. American horses, like our own colonial breeds, are short in the back, therefore the side-bars can be made proportionately short. Colonel Crichton also referred to numnahs. My experience in different parts of the world on active service convinces me that it is practically impossible to keep any description of numnah in a serviceable condition. It picks up mud, dirt, and sweat from the horse's back, and, after a time, no matter what pains and trouble are taken, the numnah will get hard, and so perfectly useless. As far as blankets are concerned, I am fully convinced that Colonel Crichton's views are sound in respect to the advantage of having a blanket with a numnah to begin your campaign with. The numnah, after a short time, must become unserviceable and you can then fall back upon your blanket, but if you start with a blanket alone, its texture gets thin sooner and it suffers in proportion. With reference to saddle bags, Colonel Crichton pointed out that the great drawback is that they are carried on that part of the horse which is the weakest. This, no doubt, is the case with the patterns which he has brought before your notice to-day, except that of the American Government, and this defect is conspicuous in the case of the Italian saddle equipment. In this instance the whole weight of the saddle bag in which the kit is carried hangs over upon the short ribs of the horse, which is the weakest part of the horse's back. The saddle bag which the American cavalry use, and an adaptation of which has been strongly advocated, hangs below the rider, practically in a line with the 14th vertebra, the centre of gravity of the horse, and rather in front of it. With regard to the carriage of the rifle or carbine: this is a subject upon which much controversy exists among Officers of great experience in campaigning. My own experience is that it is impossible to carry the present magazine rifle, weighing 11½ lbs., upon the saddle. It is not practicable to balance so great a dead weight. This argument must hold good also as regards a magazine carbine. The carbine as it is now carried can be balanced at starting by the 8 lbs. of corn, on the near side, but as the corn is consumed so is the balance of the saddle destroyed. The rifle, and I venture to think also the carbine, must be carried on the man's back. I know that some Officers hold that the physique of men campaigning will not stand the weight of a rifle for any length of time. I have always found that it is a mere question of habit, and that men get wonderfully soon accustomed to the weight. To give an instance, during last autumn, with men comparatively untrained and little used to campaigning, it fell to my lot to march 70 miles in sixteen hours in order to test this very point. The magazine rifles (11 lbs. dead weight) were slung over the men's backs, by means of a broad buff sling attached to the rifle by adjustable metal fastenings. The men, after marching 57 miles, were halted for a quarter of an hour or twenty minutes to gruel the horses. Though the men were allowed to take off their rifles if they wished, not one availed himself of the permission. The march was then completed, and the men complained in no way of the weight of the rifles, either upon that night or the following morning. We can only hope that this

interesting lecture to which we have listened may pave the way to a reduction of the weight to be carried by mounted troops and to the provision of a light and durable saddle and saddle equipment, upon the lines, perhaps, of that in use by the American cavalry.

Veterinary Captain SMITH: I am sure we are all exceedingly obliged to Colonel Crichton for putting this matter before us in the way he has done; his lecture has prevented these foreign saddles being entirely lost to us. The point, I take it, is simply, what have we got to learn from an examination of this saddlery, and how far can the good points be applied to our own particular purposes? I hold that it is utterly impossible by a mere examination of the equipment to settle what points are likely to be of any service to us, unless, as the lecturer pointed out, the whole thing be put to a very thorough test. I am afraid we have not hitherto given our saddlery equipment that severe trial which it certainly needs, in order to settle the best type of saddle to be adopted. It is certainly absolutely necessary that no important article of saddlery equipment should be adopted unless it has undergone at least a 200 or 300 mile march under trying conditions. I cannot think, however, from the little I know of the subject, that this collection can be taken as representing the patterns of saddles which exist on the Continent. Unfortunately the German saddles are not represented at all. I believe they have at least three or four different types of saddle, which it would have been very interesting to us to have learned something about. The French also have three or four types, and certainly the drawing of the English saddle does not represent the sole type of saddle used in our Service at the present day. On this point I may say that Colonel Crichton has referred to the horse, covered over with sores, which figures in my "Manual." Of course, I did not mean to say, for one moment, that any one horse ever presented so many injuries on his back; but I may add that the saddle which is capable of producing those injuries exists at the present day in exactly the same way as it existed at the time I wrote that pamphlet.[1] Colonel Crichton refers to the "points" of the saddle. The object of the points was to prevent the saddle from turning when a man mounted in a hurry. You find exactly the same "points" in some saddles of the armour period, which run not only from the front arch, but also from the rear arch, extending some considerable distance below the rib. Referring to the fit of the side bar, I may say that it is as necessary that it should fit as accurately in its depth from top to bottom as in its length from front to rear; but, owing to the fact that the curve of the side-bars from top to bottom is shorter than in their length, it does not appear to be so important. The Austrian steel side-bar does adapt itself, not only to the varying shape of the back in its width, but it also adjusts itself to the curves from front to rear. Perhaps, however (and here my opinion is opposed to that of the lecturer), the important point in the lecture, so far as the Service is concerned, is the question of pannels *versus* blankets. There is fashion in everything; and, at the present day, the fashion in saddlery is the blanket. But I hold, that so long as we have our saddles made up with rigid, unyielding side-boards, that it would be almost impossible to expect our backs to be kept in a perfectly satisfactory state, if we simply have a blanket placed beneath the saddle. Let me say why I believe the pannels to be superior to the blanket. The explanation is this: the hair in the pannel has a tendency to shift, and to adjust itself in such a way that a side-board, which does not perfectly fit the horse, is made by the adjustment of the hair in the pannel to fit him fairly well; I do not say to fit him as well as the Austrian automatic tree—very far from it; but certainly it fits him better than a blanket folded in a certain number of folds, equal in thickness from front to rear. I conceive, therefore, if we have to use the rigid side-board, the hair-stuffed pannel beneath the saddle is essential. How is it, however, that pannels have been brought into disrepute? Simply for the reason that we reduced the amount of hair in the pannel from 3 lbs. to 1 lb. 4 oz.; and when we reduced the pannels to that extent we rendered them practically useless. You might just as well put a certain number of sheets of brown paper beneath the saddle, for they would have done equally well. If we place more hair in our pannels—if we come back to the original 3 lbs., we might use the unyielding side-board, and have a fair amount of

[1] The lecturer's remarks would lead one to believe otherwise.

success, whatever length of campaign we were called upon to undertake. Another advantage in the pannel (and I find the lecturer did not think very highly of it) is the chambering which a pannel can undergo, and which, of course, you cannot possibly apply to the blanket. You can chamber your pannel in such a way—and I speak with a certain amount of experience on this subject—that you may work your horse without any danger of the sore back getting worse. That is a most valuable circumstance, and one which should not be lost sight of. At the same time, I am a firm believer in the use of the blanket to make good the condition which the horse has lost. There can be no doubt that a good blanket will be essential in future. We cannot possibly discuss this question of saddles apart from the horse. What is the use of saddles? The use of the saddle, in the first instance, is increased comfort to the rider; but it is something very much more than this. The next use is to distribute over the horse's back the weight which he has to carry. We could easily distribute this weight if all parts of the back were capable of bearing pressure; but we know perfectly well that there are certain parts of the back which are not capable of bearing weight. There are some parts that we must be most careful to avoid. Still, the distribution of weight may be readily carried out, in spite of this fact, if on all parts of the back the pressure could be imparted in the same particular way. We know it cannot. The pressure you put upon the back behind is totally different from the pressure in front. In other words, the pressure on the rear arches is totally different from the pressure on the front arches. It seems to me that even these difficulties might be overcome if all horses had the same size and shape of back; but they have not. But the most serious difficulty of the whole lot is, that when horses are undergoing severe and violent work, their backs are changing in shape. The muscles which were plump and full before they left barracks have now commenced to become wasted; they get hollow, and we have from the shoulder to the loins a huge gutter formed. Practically, from the saddlery point of view, the muscle on a horse's back simply represents so much stuffing, the object of which is to prevent the ribs from getting bruised: for the horse does not carry the weight upon the back, but upon the ribs; and, since we have a loss of flesh upon the ribs, obviously the more the weight of the saddle and man is brought upon the horse, and injury results. Therefore, this constant alteration in the shape of the horse's back, as the result of work, tells us that we must have a tree which will adjust itself, in order that the side-bars may lie evenly on the back. That is a very important point in the Austrian steel-fitting tree, where, to bring it about, we have a certain number of hinges introduced in a most ingenious manner. I can speak from experience on this subject, because General Keith Fraser has permitted me to try the saddle for some considerable time. I have had it on a large number of horses, and have never found a horse yet that it could not fit. With our own Service saddle, the difficulty is to find a horse that will fit into it; with the Austrian saddle the reverse is the case. It automatically adjusts itself to the varying shape of the horse's back. The side-bars open or close, depending upon the size of the muscles of the back; and, therefore, we always have the weight distributed equally from front to rear, and from top to bottom. With this kind of tree you can place your blanket underneath of the same thickness throughout, and you have your man's weight equally distributed; but, until we have got a self-fitting tree, I hold that we will find it necessary, when we call upon our horses to perform anything like severe work, to have good pannels on the saddle and a good blanket beneath them.

Veterinary Colonel LAMBERT: I wish to make a few brief remarks with reference to the saddle-tree. I happened to see a copy of an original Moorish saddle and a Mexican saddle, also of an old Spanish saddle, all, of course, derived from the Moors. It was rather a remarkable thing to notice how, in the whole of those, the original saddle-tree used long before the Mahommedan era by Oriental nations is still retained. It is the parent of our military saddle trees, and, though called the Hungarian, was for ages employed before the Hungarian nation came into recognized existence. I have had great experience with the blanket on service. It was extensively used in the Zulu campaign by the 17th Lancers, of which regiment I was the Veterinary Officer. I do not know how we could have got on without the blanket. We had the numnah, but we also had a very large thick

blanket. It weighed about 8 lbs., and was of a fawn colour. We found it a very great success. There is one advantage of the blanket as to which I do not quite agree with Professor Smith regarding its merits as compared with panels, and that is, we found that if you have an abrasion or a slight sore, with a blanket you can often still go on working the horse, and very frequently it does not appear to get any worse from any chafing by the blanket. With a pannel, however, it is different. You cannot on service conveniently chamber the pannel, and the horse will therefore only get worse. We know that horses on a campaign, if they are not properly foraged and are hard worked, lose flesh rapidly, and then their saddles will not fit. No thickness of pannels would obviate that, and, besides, you would not have in the field the means of readjusting the pannels so as to fit. You could, however, fold a blanket as you like. The blanket has been tried in earlier wars, as will be seen by an extract from a book published by General George Hanger in 1814, in which he said, "In the British Legion in America we had no sore backs. Our blanket, six or eight times doubled, was always laid between the horse's back and the saddle. If our cavalry on service could have a blanket eight times doubled under the saddle it would be of great utility, and you will never have a horse with a sore back." No doubt he exaggerates in saying "never," because you are certain to get sore backs, however careful you are. A great deal depends, of course, upon the work which has to be done. With regard to the numnah, as has been said this afternoon, it gets out of order, and, in the 17th Lancers, in Zululand, we found that it did so very often. When this occurred the numnah was discarded, and the blanket was used alone. Of course it seems quite a minor point as to what the colour of the blanket should be. In the artillery, in Natal and Zululand, for instance, a white blanket was used. We find that a good many foreign nations use a white blanket, and the reason is this. If you have a dark-coloured blanket, the dark colour allows of the fraudulent employment of inferior material, which is, however, easily detected in a white blanket. The blanket must be of good substance, a flimsy light one is a very great mistake. It has always struck me as disadvantageous to send a saddle right away to be tried by regiments, because every regiment tries a saddle in a different way, and very often from different points of view. I think it would be well for any Saddlery Committee to have all trials made within its easy reach, so that its members might go at least once a week to see how matters were going on, a most important point.

Mr. BYWATER: I have listened with great interest to this lecture. Amongst the important subjects dealt with is one illustrated very forcibly by the diagrams. One is struck by the diversity of the shapes of the seats of these saddles, and it is a fact that the position in which the soldier should sit has never yet been satisfactorily defined. There are a great many opinions as to whether the riding on the fork or the adoption of a hunting seat, or something approaching to it, is the more correct. Certainly for the saddler it is a most important point, because, unless he knows what is required, he is utterly at sea as to what to construct. Now the Danish saddle is as straight as the Dutch is deep, and I should say of these two the Dutch is the better. There is no doubt that, fifty years ago, there were fewer sore backs in the hunting field than there are now, simply because the hunting saddle of those days was deep and broad, and the rider sat very much towards the centre of the saddle, whereas with a very flat seat, such as the public now generally desire, the rider sits anywhere. With regard to the saddle which has been made for General Fraser, I may add that the bars to a certain extent have an elasticity, which enables them to conform to the shape of the back longitudinally, as well as adjusting to the grip. I do not know that I have anything else to remark, except that it will be a very happy day when the position of the rider is definitely decided.

Major-General MONTGOMERY-MOORE: I should like to mention a saddle that I saw years ago in Algeria, of which I have never seen the principle put forward since. The saddle itself, on which the man sat, was like an arm-chair. The numnahs underneath were six square pieces of cloth fastened together. I have marched many hundred miles with a Spahi there, and the Spahi sits in this saddle like a little arm-chair with a back. He can sit in as many positions as a man could sit in an arm-chair. Of course he has only himself to carry. The principle of the

six pieces of thick cloth, which were all of different colours, underneath the saddle, struck me as an extremely useful one. The Spahi marches longer distances than any cavalry on this side of the Atlantic. He thinks nothing of turning round in the saddle and galloping off, and he will go on in a sort of canter for 100 miles. I think if, instead of either the numnah or the blanket, the separate pieces of cloth could be tried, they might be found an advantage. You can transpose the pieces next the horse's back one after another, so that if one gets hard or wet you simply change it for another. In the long distances I have marched with them I was very much struck with their great suitability for our saddles. With regard to what Colonel Hutton was saying about the rifle being carried over the shoulder; I have marched with the Chasseur d'Afrique, and it certainly struck me as one of the most clumsy arrangements possible at first, but, after marching long distances and talking to the men about it, the comfort that they found it, just dropping the right end behind and adjusting the butt, they say they would infinitely rather have it than carry it in any bucket whatever, and at the end of a long march the discomfort felt from the carbine seems almost infinitesimal. One has tried it one's self shooting, and in going into jungle: I have always preferred carrying the rifle slung across the shoulder; it is much more convenient, and can be got at very much more easily. What was mentioned by Professor Smith is one of the most important points, viz., the reduction of the condition of the horse, and that no saddle that does not allow for that as a first principle should be considered at all. That, I understand the lecturer, is considered in the Dutch saddle. That, no doubt, is very important. Then, looking at the seats, I think the cowboy saddle gives you the idea of the most comfortable seat of the lot. The flap mentioned by Colonel Crichton is well worth trying. You get rid of weight: it moves with the leg, and seems just the thing you want for the saddle, although to the eye of the cavalryman, perhaps, it is not very ornamental.

Major J. HORTON: General Fraser and Gentlemen, I have been following the saddlery question for the last thirty years, and I am well acquainted with what the Committees have done during later years. The American pattern saddle spoken of has been brought prominently before the Services from time to time. It has its advocates and opponents; one disadvantage, it will not carry the kit as the Service at present consider it should be carried. Before we make a saddle we should first determine the maximum weight to be carried on it, whether it is to carry 22 or 23 stone or more. And as it is the arches of the saddle that carry the weight, and as we find if a saddle gives way it invariably gives at the front arch, we must consider and determine suitably that point first. The latest pattern front arch will stand a dead pressure of 8 cwt. The saddle I see on the chair is a Nolan modified saddle, a wooden saddle, well known in the Service; it is about the best military saddle we ever had, but it would need altering to suit present requirements. We have had several patterns of saddles while other nations have been contented with one. The French saddle now shown was in use in the French Army sixteen years ago. We fail because we will go in for lightness in the wrong place. We seem to act upon the principle of building a house and allowing the foundations to be weakened while story upon story was being added.[1] We must begin with the foundation of the saddle, which is the saddle-tree; we can then add weight, but with some limit. We have a Service saddle which will only stand 4 cwt. strain on the front arch. Some one determined, until higher authorities interfered, that it should carry pickaxe and shovel and all kinds of *impedimenta* in one bag, and they were to be hung on the arch; and this weight on the saddle was to be in addition to the marching order kit and the weight of a non-commissioned officer,

[1] I saw a saddle to-day that illustrates the point. A would-be inventor has taken a Service angle iron arch saddle-tree, which is already too weak, yielding at a pressure 2 cwt. below what is now considered a suitable strain; and he has cut away the metal of the front arch by a series of slots, reducing its strength in consequence by 1 cwt. At the same time he has added excessively heavy iron staples and plates to the side-bars, quite double the thickness and weight necessary for the purpose intended. He has added weight where it was not required, and taken away weight where it was absolutely necessary for the maintenance of strength in the vital part of the saddle-tree.—J. H.

who would in all probability be 14 stone. We must remember that anything above 11 stone, which is calculated as the approximate weight of the rider, must be put on the saddle as extra weight to all that is laid down in the Regulations. I knew one very stout farrier sergeant who was about 16 stone weight without accoutrements. After seeing a poor horse work in marching order under him one field-day, I obtained the Colonel's permission to inform him privately he was in future to put nothing on the saddle in his valise and wallets but straw. He was to appear only outwardly to be all right. The American saddle tried lately is not so strong as the one that was in the Exhibition, and which is the American Army saddle. One American pattern tried for rank and file was an Officer's saddle, and a very light saddle too. At the American Exhibition a few years ago I picked up the Whitman saddle, and said to the agent, who had all kinds of American saddles on sale, "This is a very light saddle." He said, "Yes; but none of the ranch men will buy the Ranch saddles from us unless they are 40 lbs. in weight. Ingenious people sometimes say, "Here is a light saddle for the British Army;" but on examination of the article it is found the straps and parts are flimsy and unsuited to last one half the time they would be expected to. A saddle must have sufficient strength to last a reasonable number of years, which means a certain addition to weight. I had a bit the other day that was 6 ozs. lighter than when it was first issued, owing to constant wear and cleaning, so that it seems to me that if everything is to be issued on the very lightest principle they will only last about one-third of the time that they are supposed to do at present, which will very materially increase expense. In reference to girths and their attachment, if we examine old prints of the last century, from plates by Wouverman and others, we shall find that the girths are shown attached to the front of the saddle. After that time we get back to central girthing. The seat in that case was very short; the man had to sit right in the middle of the saddle, almost straight legged. One gentleman who spoke just now said, "The seat should be defined," or, who is going to define the seat? I say the seat is strictly defined, and a very good seat it is: and if we ride according to the definition given in the Regulations we shall ride in the saddle in a manner that it will well suit. The Hungarian saddle is similar to the Austrian, only the one has a shabraque shown and the other has not. I went carefully through these saddles when they were at the Exhibition, some of which I well knew. The whole of the foreign saddles in possession of the Government I believe came before the Saddlery Committee some years ago. One thing should be particularly noted, mostly all the saddles shown on the diagrams are worn with more stuffing or padding than we have been lately using. The Russian saddle depicted is a new saddle, but there is another new saddle for the Russian Army somewhere. I was struck with the very pretty way this particular set was got up. The smell of Russia leather which it had is given to it by a special preparation of oil. The Russian Service black harness and saddlery is similarly prepared. With regard to the principle of the blanket and pannels, if you put five people to decide upon this point I am sure you will never get five of one mind. The great cause of all the trouble of the past has been that we rather exaggerate when we have to do anything. Some nine years ago the attention of the authorities was called to the fact that the saddlers, to save themselves trouble, instead of taking out the old stuffing, which was excessive, and restuffing the pannel, used to put a little fresh hair on the top, while the old stuffing was left as hard as a door mat. The consequence was, those who looked after regiments pointed out that the pannels wanted a little less stuffing, and that properly put in. I am bound to say, from all I saw and know of recent events connected with saddlery made public, that the faults were exaggerated, and that actual faults were caused by not having sufficient stuffing in the pannels. I will take the very worst pattern universal saddle we have, and use it on any horse in England up to my own weight without a sore back. I have seen 300 horses of a regiment march 200 miles all with these "bad saddles" on, and there was but one sore back; 150 of the horses were young, and had joined after the return of the regiment in question from Egypt. The one sore back was that of the drum horse. The pattern saddle was nevertheless faulty; it was not by any means a good saddle. And now as to pannel, numnah, and blanket. I do not care which you have; the great difficulty is none will agree (I am

afraid, although wanted, if hair pannels are not used) to have all three. If you have a properly stuffed pannel and a blanket you ought to go anywhere; there is not the slightest doubt about it; but the objection is, the hair pannel requires a skilled tradesman to adjust it. My opinion is, after seeing nearly the whole of the trials and carrying many out, that you want an underlining to your side-bar, so that you can adapt them, without an artificer, to meet the longitudinal differences of horses' backs, and you want your blanket for the use that Colonel Crichton has so well put before us. Personally I prefer the numnah underlining, similar to the new saddle which General Fraser advocates. You may call it an underlining or, what it is best known by, a numnah pannel. It is the best thing you can have for the purpose. It will not get stiff unless thoroughly neglected or clotted with oil and dirt other than from the horse. I inspect hundreds of numnahs returned from regiments, and I do not find six hard ones to a hundred soft. The numnah is of woollen felt, and should it get hard you have only to roll it up and rub it in your hands as I do now, and it will get soft enough. You may use your blanket without a numnah underneath the numnah pannel if you like, as the numnah has more cohesion to the blanket than has the smooth side-boards. At Aldershot ten years ago we had for trial under the saddle 150 blankets. A General Officer carried out the trial. I saw these blankets under the saddle daily before they went to the field and when they came in. We turned the front of the blankets back to catch under the front of the saddle bars; but the blankets did work back in some cases. I may tell you it depended upon the pattern of the saddle used. We carried the plan out very well with the wooden saddle, as the wallet staple does not entirely cover the front point of side-bar, but when saddles with a point plate and wallet staples on the extreme end of the bar were tried, we were not able to get the blanket to grip. The blankets as padding answered very well, but the heavier the blanket the more the horse sweated, and we found that the horses which carried the heavy blankets were a quarter of an hour or twenty minutes longer being dried and groomed than the horses which had lighter blankets or that had worn hair pannels. The benefit of having a numnah pannel with a blanket is, that as the blanket fills up nearly the whole channel of the front arch, you may with the pannels build up the arch to suit a horse with extreme high withers. It is said you may fold the blanket in various ways to meet this difficulty: granted, but you cannot stand over every man and tell him what he should do, and if you did tell an individual you cannot see when the cloak and kit are attached whether it has been done or not. The fact is you want something along the bar that will allow you to build up an arch for those horses which require a very high arch, about 5 per cent., and that the safety in other cases may not entirely depend upon the accidental folding of the blanket. If not it will result in having to make high arches for every horse, and that will be a great evil, and because we have been working back for years from the high arch to the low arch. A few words in reference to the felt numnah question. Fifteen years ago Colonel Crichton strongly advocated that the numnah should be of leather; I advocated felt, as the said leather numnah smoothed over the inequalities of the animal's back, making it like a mahogany table, giving no grip for the saddle. There were also other reasons. This felt numnah Colonel Crichton now advocates was well tried, but he has changed the pattern several times since; the fault found on trial was that the stitching broke away by the bending and reversing every other day. It is not, in consequence, so serviceable as the other pattern. The self-adjusting bar saddle is not novel; the Danish and Belgian saddles have the same principle; it has been before the public in different shapes for many years. It is a good principle. One patentee has shown an adjustable bar longitudinally, made of thin flexible steel. If you dropped the saddle on the floor the bar would probably take a bend, a permanent set, that would not perhaps be seen, and which would, when in use, prove injurious. Colonel Crichton is a great advocate for brass buckles, as we all are, because they are so much easier to clean than iron ones. I have always advocated the wood arch saddle, as the iron or steel arch is always so liable to be bent by accident; the wood arch saddle is not so liable; it stands a great deal of throwing about. I have seen them in use during the last thirty-two years, and pass many for repairs daily. In the regi-

ment I had the honour of serving in, the Colonel considered them excellent saddles, and with his permission we hung on to them, and repaired them year after year, until there was not a repairable part left.

The CHAIRMAN (General Keith Fraser): Gentlemen, in the winter of this year, at a lecture in Dublin, Lord Wolseley stated that it was not at all creditable to the Service, and especially to the mounted branches, that we had never been able to invent a thoroughly good and practical saddle. I must say I think what we have heard to-day, the opinions we have heard on the varicus saddles on the walls, the pictures of which we see, and the presence of so many Officers and gentlemen of various trades and professions, shows that this subject has not escaped attention, and if the cavalry have done wrong we share the blame in very good company. For hundreds of years cavalry soldiers have been trying to get a perfect saddle, and I do not suppose in 100 years to come we shall even get it. I even very much doubt whether the boot of the infantry soldier will ever be perfect, nor, I believe, is the best description of repeating rifle quite settled yet. The boot of the infantry soldier has to fit one animal, but the tree of the saddle has to fit two animals, the horse and the man. If it does not fit both it won't do; it will ruin the horse at all events. If you do not get a good seat for the rider; if you do not get well-fitting short side-bars, and arches that do not spread, you will injure the horse, there is no doubt about that. It is not so much the fault of the cavalry Officer in our Service, for a study of the Reports of Committees on Saddles for a great number of years will show that there are very few of the opinions of cavalry Officers that have ever been acted upon. All sorts of Officers of other branches of the Service have given their opinion, and the decisions have generally been based on economical reasons, or on somebody's fanciful views on this thing and the other. The wooden saddle was given up because it was recommended as being cheaper to have the iron saddle. Another reason given was, that some of the rivets of the seats had become detached from the wooden cantle. Wooden saddles were used for hundreds of years in many countries, and up to this day in almost all European armies. The Hungarian saddle (on the lines of which the old English saddle was built) is generally admitted to be the best. One reason was, that it was extremely simple. It used to be a wooden tree and plain wood side-bars, and the seat could be laced up in front to let down behind, so as to place the man in its centre. The old English Hussar saddle gave a man an excellent seat. It was a very simple saddle, and it was an unfortunate day when we began to change. That saddle went all through the hot weather campaigns of the Indian Mutiny. Someone has said rightly, the iron arches would not stand the great heat and cold of America. In the burning climate of India the wooden-arch saddle went well through the whole of the Indian Mutiny, and the number of sore backs was excessively small. Since that we have had every description of iron. We have tried everything. The experts at Woolwich told us the flat iron could not spread, but in two or three years our cavalry suffered terribly from sore backs and girth galls, owing to the arches having spread. Then the angle iron arch was brought in, and expert evidence was given that it was quite impossible that *that* could spread. The question was asked, "Did not you say the same thing about the flat iron arch?" "Yes, but this *cannot* spread." Now we all know the angle iron arch does spread. And now we have the steel arch, and even the steel arch has spread, but not much, as it has not been used very long. It is true that a certain number of saddles with the flat iron arch, the one that has given all those sores which Professor Smith has graphically described in his little book, is still in the Service, but it is at last going to be called in. The angle iron arch saddle is being strengthened with a steel bar, and that I hope will keep it from spreading any more. All metal arches will spread in time, I feel quite sure, and my opinion is shared by people of much greater knowledge than myself. One of the most important of the questions raised to-day is the seat of the soldier on the horse. I was very glad to hear Mr. Bywater draw particular attention to that. It is utterly impossible that the saddle shall remain to fit the horse if the man does not sit properly—if there is not a good seat for the man. He said nobody ever had decided what the seat of the man should be. I think there is not a bad description of the proper seat written a long time ago by Xenophon himself in his admirable "Treatise on

Horsemanship." He says: "We do not like that the man should sit as if he were on a carriage seat, but as if he were standing upright with his legs somewhat apart, for thus he would cling more firmly to the horse with his thighs, and, keeping himself erect, will be able to strike a blow on horseback with greater force. It is necessary to allow the leg, as well as the foot, to hang loose from the knee." I think that is a perfect description of a seat. You will see the cowboys at Buffalo Bill's sitting right down in the saddle, and they can pick up things off the ground, which a man cannot do with his knees tucked up to his nose. In the French saddle, in the '59 campaign, the men sat far back, almost on the cantle of the saddle; the result was countless sore backs. You cannot sit on the back of the saddle without pushing the saddle forward, and getting sore backs and girth galls; girth galls really are unknown in the Austro-Hungarian army. I am happy to say they are very rare (owing to the immense care taken) in our own Army, still we have a few, and if you look at the English cavalry riding on these old saddles you will find it is quite impossible that they should sit anywhere except on the back of the saddle, and that they must keep on pushing it forward. As long as the lowest part of the saddle is quite over the centre of the girth then the man sits in the centre of the saddle, and the saddle must be placed over the centre of gravity of the horse. The man feels much less movement. With regard to what is the proper seat of the cavalry soldier, I do not think there can be any question. With regard to the pannels or blankets, there are a great number of differences of opinion. I think the chambering of a pannel is a risky thing, and you cannot get men always on the spot to do it. I know even at manœuvres you will see the saddlers at work all night, trying to teaze and chamber the stuffing of the saddles. On service you may not have men capable of doing that, whereas the blanket can always be altered to fit. In the American War a Confederate General commanding the cavalry said no saddle with pannels would do; the saddles he liked best were the McClellan saddles, which they took from the Northerners. Nobody sits more down in the saddle than a jockey. That is the seat you ought to have; the man should sit down so that he can ride about 4 inches from the saddle. Some of these saddles we know something about. The American saddle is, I believe, most comfortable; it sits the man right down in the saddle, and gives him a very firm seat. I am quite sure no hunting saddle would do for the cavalry soldier. Colonel Denison, the author of "Modern Cavalry," who is not at all a cavalry soldier, and not at all infatuated with the idea of cavalry, for he was the first advocate for the creation of mounted infantry in our service, but who has seen a great deal of mounted work, when he was commanding a detachment of his own troops on the frontier, in 1866, had some of the Hussar saddles, but not enough. He found that the greater number of horses that had an ordinary hunting saddle were almost immediately laid up, and not a single horse with a Hussar saddle had a sore back! He is clearly of opinion that the hunting saddle does not suit the cavalry soldier. The Austrian saddle is a much deeper saddle than any of our present ones. The wallets hold the men's kit, and behind the saddle he carries two days' corn and his cloak. I heard it remarked that the English cavalry was so heavy. I should like to see a comparison of the Hungarian cavalry and the English. The Hungarian Hussar horse carries 22 stone, and several men in each squadron carry large pioneer tools, spade, pick, and all those sort of things. They go out early in the morning, and come in late at night during manœuvres, and the next morning they come out fresh, and go on all day again. They happen to be very hardy horses. I do not mean to say that the English cavalry horses could not do it at all. Our cavalry horses do not, in marching order, carry more than 18 stone, and you may take the men at 11 to 12 stone. I do not think when they went to Egypt the weight even was so heavy as 18 stone. We are nothing like as heavy as most foreign cavalry, though we should all like to reduce the weight. With regard to the saddle-tree invented by Mr. Wilhelmy, of Vienna, made up for me with the jointed side-bars by Messrs. Wilkinson, it is not the least like the Danish tree, or at all on the same principle. I did not think of sending it to England till I found 500 Officers had bought it themselves to take to Gallicia, at a time when war appeared imminent. I thought there must be something good in it then. The Austrian cavalry tried it

severely in one or two regiments, with horses given to sore backs, and just before I came away in 1890, a considerable number more saddles were ordered by the Government. I have one here which has gone through every description of experience; amongst others, it found its way once to Woolwich Museum of Curiosities, having been lost during its practical trial in this country. It went through a round of trials; it has been ridden in by very heavy men, by Scots Greys, Life Guardsmen, as well as by Hussars, for the last three or four years, and has answered very well. There is another saddle that has been in the Exhibition, which Colonel Brocklehurst, of the Blues, has been building and using, also without a flap. The principle of the saddle is that if the horse is hollow backed, and the man sinks down, instead of having to stuff the pannels, as they used to, or folding the blanket over, so as to raise the saddle at the back, he slips in a pad of felt, and raises the man; or if the horse is very low in front, he puts the pad in under the front, so that it fits the man to the saddle. This has answered very well; the men like riding on a blanket much better than on the flaps; it gives them a much firmer, closer seat. We have also here a tree which has been made by an Officer of the 14th Hussars for a special horse, which he could not fit in any other way, and I believe it has answered admirably. It has had very broad side-bars. With regard to carrying the carbine on the body or not is a question that affects the saddle, because it upsets the balance at present of the saddle so terribly; anybody who has travelled much with muleteers and drivers of pack animals knows that they add great stones to one side rather than have the balance wrong. We put the weight of the carbine all on one side, and then we expect the horse not to get a sore back. I always have been an advocate for the cavalry soldier having some arm on him. It would be a terrible thing if he was to get down and be left behind as he is at present equipped, without a sword or a carbine, or even his water bottle. I have never seen any foreign cavalry who minded carrying the carbine across the back. The Aden Troop, a magnificent body of cavalry, used to carry the carbine on the body, with the muzzle down, resting, when they wished it to do so, in a small bucket on the saddle; the men did not have to pass the sling over the head to shoot: they could put it up to the shoulder, and could fire at once. I was particularly struck by it, and I have been trying ever since I saw it to get something of the kind, because after that terrible disaster which happened in Afghanistan to the 9th Lancers, owing to the carbines being on the saddles, I thought it was absolutely necessary that the men should have a firearm on their bodies in future. I am very glad to see the great interest that has been taken in this subject, and I hope the "Saddlery Exhibition," for which we are indebted so much to the Saddlers' Company, will make people pay more attention to the question of cavalry saddles. Oliver Cromwell, the finest cavalry soldier we ever had, "perhaps the finest the world ever saw," as he is described by a celebrated German military writer, said, "Let the saddler see to the horse gear. I hear many are ill served. If a man has not good weapons, horse, and harness, he is as nought." That is absolutely true now as it was then. I will now ask Colonel Crichton to reply to various questions that have been raised, if he should wish to do so.

Colonel CRICHTON: I have not been asked many questions, but I should like to say one or two things. I am very sorry we are not able to have the foreign saddles themselves here instead of only my pictures of them; but I asked the Clerk of Saddlers' Hall if he would allow us to have the saddles. He said he could not do so, because it would be a breach of faith with those Governments from whom the saddles were received. I was glad to hear Major Philpotts allow that the blanket slips were next to the horse's back. I always considered such was the case. Colonel Wood spoke about the horse-hair numnah of the American saddle. There was none in the Exhibition with that saddle; there was only the blanket that I could see. Colonel Hutton says that the numnah becomes unserviceable. I know it does become unserviceable in time; it gets hard and then gets holes in it. That is the reason why I advocate the reversible numnah so strongly. It will last four times as long as the ordinary numnah, because there are four ways of wearing it. Then with regard to carrying the carbine, I am an advocate for carrying the carbine on the body, but I think General Fraser's way of carrying it, partly on the

man and partly on the saddle, is much better than carrying it altogether on the man. I tried it this year on this principle, carried over the man's shoulder by a strap, and the muzzle in a little bucket. When the man dismounted, the carbine of its own accord came out of the little bucket and dismounted with the man in a very neat way. When the man mounted with the carbine hanging on the back he had to guide the carbine across the horse's back and then deposit it in the bucket. With regard to the injuries on the back of horse in the book of "Saddles and Sore Backs," by Veterinary Captain Smith, I know perfectly well that such injuries, caused by the particular iron arched saddle there shown, have existed, and the only reason why I drew attention to them was that I wanted to show that it was the fault of the saddle itself and not the fault of the Officers, because it gives the impression that regimental Officers do not pay proper attention to their work, and that it was from this cause that all these sores came on the horse's back. The saddle which caused them, I am happy to hear now, will no longer be in the Service. With regard to the points on the saddles, Veterinary Captain Smith told us some saddles had points behind as well as points in front, and the reason given was to prevent the saddle turning when mounting. That I always heard was the reason, but I never could think it was a good one. Certainly, anyone who has seen the cowboys drag themselves up from under the horse into the saddle would think their saddle ought to have points, but it has none. I do not think there is any necessity for these points, if that is the only reason that can be adduced for retaining them. With regard to what Major Horton said as to leather and felt for numnahs, I confess I think he was right about the felt being better than leather. I found that leather numnahs were excellent, but when they were subject to rough work the leather cracked, and therefore was no good. It is all very well for a gentleman's private stable, where it can be kept in good order and is not subjected to different climates, but it did not stand rough cavalry work. But with regard to the reversible felt numnah, I am perfectly certain that the reversible numnah is the right principle, and will last four times as long as the ordinary numnah. I will read a letter that I have had from Colonel Maberley, of the Scots Greys, on the subject of this equipment, in which he says: "I am sorry to say all your saddles were taken away from us at Brighton, shortly before we marched for Ireland. As you may remember, I had the whole of my troop fitted with these saddles and marched from Edinburgh to Aldershot with them, had two seasons at Aldershot, and thence to Brighton, by which time I had almost ceased to think of sore backs or girth galls; it was quite the best saddle for the purpose I have yet seen. The numnah being fastened behind as well as in front kept the rug in its place and the back-bone cool; the horses did not sweat so much, and cooled sooner after work. I only wish I had them in use throughout my regiment at the present time." With regard to my saddle and the tree being the same as the regulation saddle, it is very nearly the same as the regulation saddle, but there are one or two little differences. I followed the regulation pattern as nearly as I possibly could, because I got them cheaper from having them the same pattern; but, at the same time, I should be very glad to go back to the wooden saddle-tree. I thank you for the kind way in which you have attended to what, I am afraid, has been a rather dry and uninteresting lecture. The good attendance, however, and the interest taken in the lecture, show that there is a very great deal of interest taken in saddlery at the present day by Officers of the cavalry, both past and present.

Colonel WOOD: It seems to me, as all these saddles are in the country, that it would be a thousand pities if they were allowed to go out of the country. I think that we, as an Institution, ought to acquire those saddles, by hook or by crook, so that they may be kept for the inspection of Officers who wish to study the subject. Would it be possible for this meeting to express some wish of that kind?

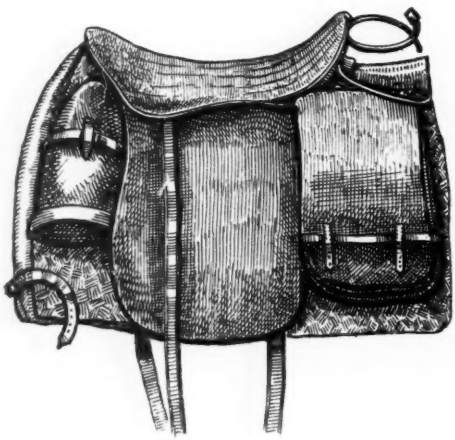
The CHAIRMAN: I also think it would be a great advantage if we could obtain them. I believe the Saddlers' Company got them through the Foreign Office, and I do not know whether they can be purchased.

Colonel WOOD: May I propose to the meeting: "That this Institution is of opinion that it is most desirable to obtain the saddles if possible, and that steps should be taken for the purpose."

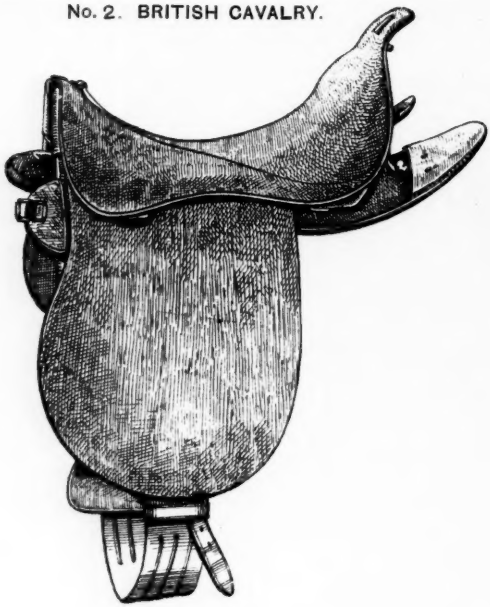
Colonel BAYLISS: I shall be happy to second that.

The CHAIRMAN: I think we may say that that will be carried unanimously. I understand that it is the unanimous wish of this meeting that the saddles should be kept, and that the War Office should be asked that, if possible, they may be retained in England.

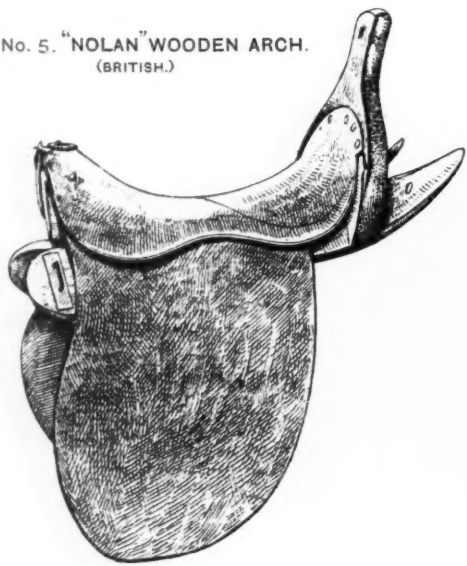
No. 1. RUSSIAN.



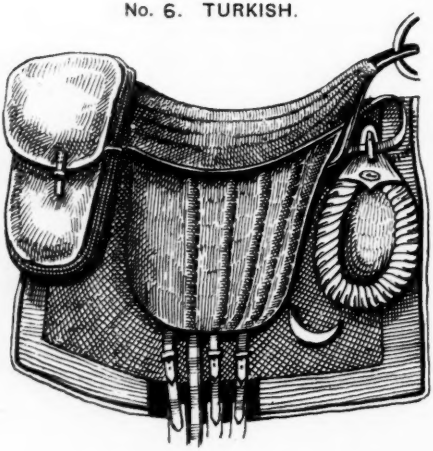
No. 2. BRITISH CAVALRY.



No. 5. "NOLAN" WOODEN ARCH.
(BRITISH.)



No. 6. TURKISH.



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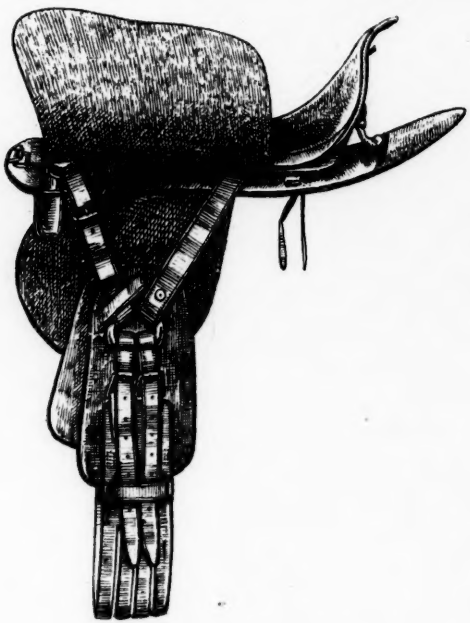
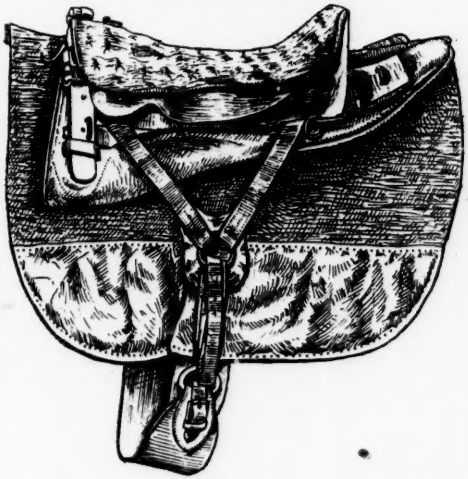
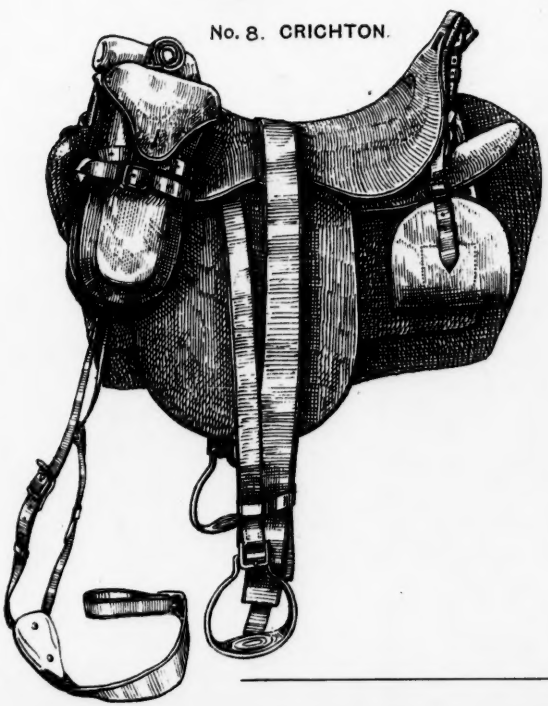
No. 3. BRITISH CAVALRY (FLAP UP)



No. 4. MAJOR BROCKLEHURST
(ROYAL HORSE GUARDS.)



No. 8. CRICHTON.



No. 7. COW BOY.

Friday, July 15, 1892.

CAPTAIN WILLIAM DE WIVESLIE ABNEY, C.B., R.E., F.R.S., &c., in the Chair.

COLOUR BLINDNESS.

By R. BRUDENELL CARTER, Esq.

MR. CHAIRMAN,

It has long been known to those engaged in the pursuit of natural philosophy, and, to some extent, also to the general public, that a certain number of persons are so organized as to receive sensations of colour which differ, either in completeness or in kind, from those of the great bulk of the community. The persons so affected have been described, not very accurately, as "colour blind;" and, until lately, the various forms of the defect were regarded as collectively constituting a somewhat rare condition, which was, indeed, a proper subject for the exercise of scientific curiosity, but which was only of slight practical importance. It has been reserved for our own time to discover that colour blindness, in one or other of its forms, affects rather more than 4 per cent. of the whole male population of civilized countries, and that it affects certain classes in a still greater proportion; while, at the same time, industries have sprung up, and have attained considerable development, in which the employment of colour blind persons may easily occasion, and in all probability actually has occasioned, the occurrence of very serious calamities. It is sufficient to point out that the safe working of railway traffic and of steam navigation is almost entirely dependent upon the use of colour signals; and for these signals the colours which must chiefly be used are red and green, the very two about which the colour blind fall into perpetual error and confusion. It seems to be imperatively necessary for the security of life and property that persons with defective colour vision should be excluded from these employments, or at least from any duties in relation to them in which accidents might be brought about by their incompetence.

The whole subject of abnormal colour sense is a somewhat large one, to which it would be impossible to do justice within the limits of a single lecture; but it is my good fortune to address an audience before which the introduction of elementary matter is uncalled for. I need only remind you that what we call the sensation of white light, such as that of the sun or of the electric arc, is not only produced by

the impact upon the retina, or nervous expansion within the eye, of a rapid succession of waves of the luminiferous ether, but also that these waves must be of many different magnitudes, so as to afford a blending together of many different amplitudes of vibration. When a beam of such white light is suffered to enter a dark chamber, it can be analysed, so to speak, by the interposition of a prism; with the effect that it will not only be compelled to deviate as a whole from its original straight course, but that the deviation will be much greater for small and rapid waves than for large and slow ones. A beam of white light, originally circular in outline, will be thus extended into a horizontal band, in which the largest waves will be at one end of the band, and the smallest at the other, while the intervening magnitudes will be evenly distributed between the ends in the order of their respective sizes. There will be a regular gradation of wave magnitude, from the end of the band which is least deflected from its original course, to that which is most deflected. (Prismatic spectrum shown.)

The different parts of the band thus produced will differ not only in wave magnitude, but also, and very conspicuously, in colour. The band will no longer be white, but brilliantly parti-coloured. At the end where it is least deflected, and where the largest waves fall, it is said to be red. At the end where it is most deflected, and where the smallest waves fall, it is said to be violet. In the intermediate portions it presents the well-known succession of the prismatic colours, in which, according to Newton, red is followed by orange, yellow, green, blue, and indigo, the last passing into violet. When we come to inquire into the nature of these very striking and beautiful phenomena, we find that certain colour sensations are results of the impact upon the retina of vibrations of uniform wave length, while others are results of the impact of mixtures of different wave lengths, mixtures less complicated than that which produces the sensation of white light, but still complicated when compared with the uniform magnitude of vibration which impresses the consciousness with one of the primary or unmingled colour sensations. It seems to be determined by experiment that the primary sensations are three in number—red, green, and blue; and that each one of these, when of a certain hue and purity, is produced by the impact of waves of a single magnitude. When the simple character of these three primaries was first ascertained, they were described as red, green, and violet; but your own experiments, Sir, appear to have established that the sensation of violet is due to the dilution of spectral blue with white light; and, hence, to speak of the primary itself as "blue" seems to be the more correct nomenclature. All the intermediate portions of the spectrum are admixtures more or less complicated; and not only so, but every colour which we recognize in the universe is an admixture of one, two, or all of the three primaries, in varying proportions, and with more or less white light. This fact, long known hypothetically, has received experimental proof at the hands of our Chairman, who has succeeded, by combining selected portions of the spectrum with white light, in matching the

colour of any object which is presented to him, and in recording the constitution of the match in terms of wave-length, so that it will be available for reproduction and reference at any future period. (A patch of reddish-brown paper was here precisely matched by Captain Abney's spectrum apparatus; and the colours by which, when they were combined, the match was produced were afterwards displayed separately upon the screen.)

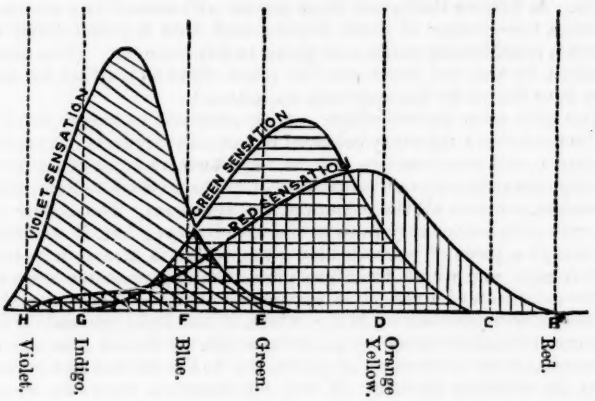
The prism does not stand alone in its power of analysing white light, although it does so in its power of transmitting the whole of the separated constituents. White light is analysed by every natural or artificial substance which presents the phenomena of colour; because these phenomena depend upon the quenching or absorption of waves of certain magnitudes, and the reflection or transmission of the residue. All colour is the result of the suppression of some of the elements which enter into the composition of white light, and few things are more curious than the great change in the properties of material substances, in this respect, which may be effected by what seems a very slight change in their constitution. Water, for example, is practically colourless in layers of moderate thickness, and will transmit the whole of the spectrum. The addition of a drop of a solution of carmine renders the water pink, that is to say, confers upon it the power of suppressing many of the elements of white light, and of leaving red to predominate. In view of this circumstance, and in view of the great variety of nerve endowment which is possessed by different individuals of the human race, it is, perhaps, surprising that the reaction of the optic nerves to colour should be, on the whole, so uniform, rather than that individuals should be met with in whom that reaction differs from the accepted type. At any rate, such individuals there are, and we must endeavour to ascertain in what respects and in what degrees the difference asserts itself.

The power of vision essentially depends upon the formation on the retina, or nervous expansion at the background of the eye, of an orderly picture or image of the object seen; an image which precisely corresponds with that produced on the receptive screen of a photographer's camera. When such an image is formed, it produces an impression upon the sensitive terminals of the optic nerve, and this impression is conveyed along the nerve fibres to the brain, where it becomes an object of consciousness. The image, when it is that of a parti-coloured object, will itself be parti-coloured in a similar manner; that is to say, its different parts will be produced by the impact of light waves of different magnitudes and combined in different proportions. We cannot positively determine the share which the eye and the brain respectively take in the discrimination of the different parts or different characters of the image; but it is at least certain that the nerve fibres which are acted upon by waves of a given amplitude must receive and convey a different impression from that which is received and conveyed by fibres which are acted upon by waves of a different amplitude. Whatever may be the colour, the impact itself is that of the luminiferous ether in wave movement; and it seems to follow, as a necessary

condition of the impression being carried along the nerve fibres, that this wave-movement must be propagated, and must excite molecular movement of a corresponding kind in the structure of the fibres themselves. If we turn our thoughts for a moment to wave movement of a coarser description, namely, to the atmospheric waves which are concerned in the production of sound, it is a familiar fact that their propagation along cords or strings will depend on the tension of those strings; and that, for example, if a series of strings be parallel, as in the common Æolian harp, and one of them be thrown into musical vibration, the vibration will be communicated to any others of the series which are tuned to the same pitch as the first, and to no others. A slight difference in the tension of a cord permits or prevents the transmission of given sound waves; and it is at least conceivable that a slight difference between the tension or other physical conditions of certain nerve fibres may permit or prevent the transmission through them of luminiferous waves of a given magnitude. The nerve fibres of the human eye possess a somewhat limited range of reaction to wave-movement, being sensitive only to vibrations which range in magnitude from about 4,000 to about 7,000 ten-millionths of a millimetre. Beyond either extremity of this range we have abundant evidence of the existence of wave-movement, in the form either of heat rays or of rays producing chemical activity, but both are invisible. An eye which differed from the average by being unable to respond to wave-lengths of more than 6,000 ten-millionths of a millimetre would be absolutely blind to red, and this colour, both in its purity and as an element in mixtures, would be invisible to it. An eye unable to respond to wave-lengths of less than 5,000 ten-millionths of a millimetre would be blind to blue; and one which was unable to respond to wave-lengths of rather more than 5,000 ten-millionths of a millimetre would be blind to green, whether pure or in combination. We may assume, at least provisionally, that some such conditions exist; for we find, as a matter of fact, that there is a small percentage of the human race to which red is a non-existent colour; that there is a still smaller percentage to which green is a non-existent colour, and that there is a third percentage, the smallest of all, to which blue is a non-existent colour. It has been said that people exist who are absolutely colour blind, and possessed only of the power of seeing light and shade. To such, if such there be, the world must be a sort of black-and-white exhibition; but the cases so described have been very few in number, and the evidence with regard to them leaves something to be desired. What is in a sense not uncommon is the existence of vision which is di-chromatic instead of tri-chromatic, or in which the third colour, if not absolutely invisible, is capable of producing only a faint impression upon the consciousness. The persons to whom this latter description applies are said to be "incompletely red or green blind."

According to the hypothesis of Thomas Young, as somewhat modified by Helmholtz, the natural eye is susceptible of the three sensations of red, green, and blue; and possibly derives this susceptibility from being furnished with nerves fitted to respond to each of

the three impressions; some, that is, to red, some to green, some to blue. The wave-movement which actively excites one of these sensations, however, is found to excite also, although feebly, each of the other two; and, the general action of light upon the consciousness is exhibited by this diagram, taken from the Report of the Royal Society's Committee, which represents the length of the



visible spectrum, with curves indicating the relative intensities of the sensations. The lines marked by the letters B, C, D, &c., below the curves, indicate certain fixed lines in the solar spectrum at which the wave-lengths have been determined, and the names of the colours indicate, in like manner, their relative positions in relation to these lines. The different degrees of the stimulation given to each of the three sensations by every part of the spectrum is shown in the diagram by the heights of the curves above the horizontal line. Thus, in the middle of the spectrum, near E, each of the curves is to be found of a different height, and these degrees of stimulation of the three sensations, combined together, give the sensation of spectral green. It may be remarked that, on the scale adopted, the three sensations are supposed to be equally stimulated when white light is perceived. The areas of the three curves are therefore equal, and at the places in the spectrum where the curves are of equal height, the stimulation of the sensations is also the same. At the extreme red and extreme violet of the spectrum the curves of the red and the violet sensations are alone to be found, hence at those parts the sensations are simple.

According to the Young-Helmholtz theory, which seems to meet the facts of the case better than any other, the two types of complete red-green blindness are attributed to the absence either of the red or of the green sensation, the absence of the former corresponding to red blindness, that of the latter to green blindness. Where the

violet and green curves cut, the red blind person will see what to him is of the same appearance as white; and where the red and violet curves cut, the green blind will also similarly describe his sensation of colour. To the normal eye these parts of the spectrum appear as bluish-green and as green, as there is a stimulation of the green and violet sensations, or of the green alone, over and above that which is necessary to produce with the red sensation the mixed sensation of white. It follows that a red blind person will accept, as a match for white, a rose colour of some depth; and that a green blind will accept a considerable amount of green in like manner. (The colours accepted by the red blind and the green blind as matches for white were here shown by the spectrum apparatus.)

The only pure colours which can be obtained in nature are those of the spectrum; for every coloured object either reflects or transmits a mixture, and every surface reflects, together with light of the colour appropriate to it, a certain proportion of unchanged white light, which, of course, contains all the colours of the spectrum. The colour of a red geranium seems very pure to the unaided eye; but, if we look at it through a piece of peacock blue glass, which is almost impervious to red rays, and which therefore places the experimenter somewhat in the condition of a red blind person, we shall see that it contains a considerable proportion of blue; while, if the light proceeding from it were accurately tested by a spectroscope, we should also see that it contains some proportion of green, due to the white light reflected from its absolute surface. It will be observed, moreover, that its surface, when seen through the glass, seems much less bright, less luminous, than when seen with the naked eye; and we may hence infer that, to the perceptions of the red blind or of the green blind, the world presents not only a very different, but also a less luminous appearance than it does to those who are normally colour-sighted. Hence it is easy to conceive that the colour blind must often fall into mistakes occasioned by their defect, and many of these have been recorded. Dr. Nicholl says, of a boy eleven years old—

"I placed a scarlet paper on the grass, and afterwards a green baize. He said that the grass and the baize were of the same colour as the paper, but that they were a shade lighter. He told me, 'What you call purple and pink and blue are so like each other that I cannot well know one from the other.' He also called the gray eyes of his sister a bluish-red. A blood relative of this lad was in the Navy, and purchased a blue uniform coat and waistcoat, with red breeches to match the blue. I showed the boy a D'Oyley which was red, having a leaf of the same colour traced out on it, and I asked him the colour of it. He having been so often mistaken and laughed at, said, with an air of triumph, 'Why, the groundwork is red, but the leaf, of course, is green.'"

Among other examples of the same kind, we have mention of a British Admiral, who painted a red tree in a landscape, and chose for himself a pair of green trousers, which he thought were brown; of an architect's pupil, who copied a brown house in bluish-green, with the sky rose colour and the roses blue; of a colour blind family of

Quakers, one of whom bought a green coat for himself and a scarlet merino dress for his wife; of a little boy, who did not at first observe the crimson blossoms of a *Pyrus japonica* in full bloom, but who said, after they had been pointed out to him, "Oh yes, I see the flowers now, but they are not so bright as the leaves;" and of a post office clerk in Prussia, who was perpetually wrong in his accounts with regard to the sale of stamps. Sometimes he had too much money for the stamps sold, sometimes too little, but seldom or never the right amount. At length it was discovered that he was colour blind, and that he could not distinguish red stamps from green ones. Similar instances, some ludicrous, some tragic, might be multiplied indefinitely.

At first sight it seems even more remarkable that the colour blind may not only remain in absolute ignorance of their own defect, but that they may also, unless discovered by some accident, entirely escape detection by the ordinarily unobservant people around them. They owe their ignorance and their immunity to what Dr. South aptly described, in relation to a very different subject, as "the terrible imposture and force of words." From childhood, they hear colour names used correctly, and they learn to use them in the same manner. They call grass green, and they call cherries red. If the two colours appear to them to be much the same, they try to discover trivial but sufficient differences by which to distinguish them, and they find these differences in differences of luminosity. The child who said that the blossoms of the *Pyrus japonica* were not so bright as the leaves was red blind. To him a red surface was not invisible, or non-existent, but was rendered visible by the feeble luminosity of the light, other than red, which it reflected. It would be a dull or dingy surface, resembling that of the leaves in colour, but not so bright. He would be told that the flowers were red and the leaves green, and he would interpret red as a dingy shade of the same colour as green. Dr. Nicholl's boy, who saw the outline of a leaf traced on the red D'Oyley, did not hesitate to say that the leaf itself was green, merely because he had been told that leaves were green, and he recognized the object by its outline. Ninety-nine times out of a hundred he would have avoided detection by calling a leaf green. I have met with several instances in which declared colour blindness has been unknown to near relatives who were in frequent communication with the subject of it.

If we take the two children above referred to as illustrations of the incapacity for certain duties which colour blindness might produce, I think it will be evident that neither of them would have been trustworthy in relation to the needs of railway travelling or of navigation. It is possible that both, supposing them accustomed to see red and green signal lights, might have distinguished these lights apart on seeing them together; but neither of them, on seeing one light only, could have declared whether it was red or green. Now it is required from the engine driver, or from the look-out man, not that he should be able to distinguish red from green when the two are side by side, but that he should be able to pronounce instantly upon the

nature of a single light, which, at sea especially, may make its appearance suddenly, and in an unexpected place. The apparent luminosity of a light is liable to be modified by so many circumstances, such as the nature of the flame furnishing it, or the character of the atmosphere through which it is seen, that luminosity alone, with no standard for comparison, can never be a sufficient guide; and yet it is the only guide which the colour blind possess. To many of them a red and a green light are absolutely undistinguishable as colours, although one may seem to be brighter than the other.

It may therefore be assumed, that persons who are completely either red blind or green blind are unfit for the discharge of any duties, either on sea or land, in which it is necessary for them to distinguish colour signals with ease and certainty; and it may further be assumed, that even incomplete red or green blindness may be of such a degree as to entail a similar incapacity. The only remaining question is, as to the best way of preventing colour blind persons from undertaking duties which they cannot discharge with safety to others, or with satisfaction to themselves.

In order to determine this question, the chief points to be remembered are that colour blindness is a matter of formation, very frequently of inheritance, and that it is absolutely incurable and unalterable. There is, no doubt, a form of colour blindness arising from disease, or, generally speaking, from the excessive use of tobacco, which is acquired, and which may be recovered from; but this is foreign to the main subject before us, which relates to congenital or structural defect. Very extended observations made in every civilized country have shown that the born colour blinds bear everywhere about the same numerical proportion, namely, among males a little over 4 per cent., to the colour sighted, and it is generally held by those who have paid most attention to the question that the most politic course with regard to them would be to discover their defect in childhood, and to restrain them from entering upon any calling in which it would be dangerous. If a boy at school were discovered to be colour blind, his parents should dissuade him from even attempting to enter any service in which his defect would be at once a source of danger to himself and others, and a bar to promotion. In the meanwhile, and until scholastic examinations are instituted as matters of course, the best alternative seems to be an examination of every man who seeks to enter either railway or marine service, and the rejection on the threshold of those who are unfit. By this course, almost as much as by the other, the infliction of hardship on meritorious persons would be avoided.

Examinations of some sort or other have now been in operation for several years, both in the Royal and in the Mercantile Navy, and in the general railway service of the country; but the results have not always been entirely satisfactory. The examination now required of candidates for the Royal Navy leaves little, if anything, to be desired; but that of the railway companies, and of the Board of Trade for the mercantile marine has been very defective. In both cases the defects have mainly arisen from want of knowledge. The colour standards

used have been unfit for the purposes they were intended to fulfil, and the method has often resolved itself into an examination on the names of colours, instead of being, as it should be, a procedure calculated to discover the existence of any peculiarity of vision in the person tested. In the mercantile marine only Officers are examined, so that the unquestionable grievance of the rejection of the colour sighted, and the risk involved in the acceptance of the colour blind, although both have existed, have not been felt by any large number of people. In railways the case has been different, and one of the Trades Unions of railway workers commenced a sort of agitation two years or so ago against the examinations in colour vision to which the men were subjected, and by which, according to the complainants, they were liable to be wrongfully deprived of their occupations and means of living. This agitation led indirectly to the appointment of a Committee by the Royal Society, with the sanction of the Board of Trade, for the purpose of investigating the whole question, and I trust that the Report of the Committee, which has now for some time been in the hands of the Board of Trade, will lead to reforms which are clearly necessary or desirable.

It would seem at first sight that the most natural way of testing the colour vision of any candidate for employment would be by the use of the very signals which he would be required to recognize in actual work; but neither for railways nor for the marine would such a method be either safe or sufficient. The lights to be distinguished apart are only two in number, and even to the most pronounced colour blind they would not appear exactly alike when shown side by side or in immediate succession. As already explained, one would be likely to be darker or less luminous than the other, and this difference would in many cases be sufficient to lead to an accurate guess as to which of the two was being displayed. Even without this guidance there would be an even chance of a correct guess; while the point of interest is to discover whether the appearance of the two lights is sufficiently different to the person tested to enable him to distinguish either of them at a glance, and in any possible conditions of illumination or of atmosphere. For this purpose, as was long ago shown by Holmgren, it is necessary to ascertain what colours resemble each other in his eyes, and the only way to do this is to call upon him to make matches from a number of coloured objects. The best objects for the purpose are skeins of Berlin wool; but their advantages depend chiefly upon their being easy to procure in a sufficient number of tints, easy to carry about, and easy to handle. But for these considerations, and also but for the absence of reflection from the dull surface of the wool, any other coloured objects would do equally well. It is necessary to lay stress upon this point, because many volunteer or amateur examiners have appeared to think that the essence of "Holmgren's method" consisted in using wool as a test object, without reference either to the colours employed or to the mode of employment. The truth is that Holmgren's method consists in the use of special colours in a very precise manner, and that the material is only an accident, even

if an important one. Holmgren desires to compel the colour blind person to betray himself by the selection of wrong colours to match those which are given to him as standards. In order that this may be accomplished with unfailing certainty, the standards themselves must be carefully selected under the guidance of adequate knowledge. The collection of skeins of Berlin wool should be about 150 in number, and should include reds, oranges, yellows, yellowish-greens, pure greens, blue-greens, blues, violets, purples, pinks, browns, and grays. Several shades of each colour, with at least five gradations of each tint, should be procured, from the deepest to the lightest greens and grays. Varieties of pinks, blues, and violets, and of light gray, together with shades of brown, yellow, red, and pink, must be especially well represented. The test skeins with which the examinees are to compare the colours should be three in number, a light green, a pale purple or pink, and a bright red. These three colours will suffice to indicate approximately the amount and kind of colour blindness which may exist. The light green skein, which is a tolerably pure green diluted with a large proportion of white, is chosen as the colour which closely matches the spectrum colour which the red or green blind accept as white or gray. It is chosen of a pale tint in order that the colour blind may be unable to distinguish its colour by its luminosity. A light gray or drab skein will present to the colour blind the same luminosity that this pale green does; and, although he may have been trained to distinguish bright colours by their relative luminosities, in the case of the pale varieties he will be unable to do so. The light purple or pink is chosen for similar reasons, and in fact it is nearly a complementary colour to the green. The purple is, according to the Young-Helmholtz theory, a mixture of two fundamental colours, the blue and the red, and as in the green blind it excites both the blue and the red sensations, it may be confused with gray or with a green. In the red colour blind it excites in excess the blue sensation mixed with what they call white. A blue or violet may therefore be matched with it.

In proceeding to the examination, the wools are thrown in a loose heap upon a white cloth in good daylight. If many persons are to be examined, twenty or more may all be assembled round the table, and may watch each other's proceedings; and they may all at once receive verbal instruction as to the course they are to pursue. The first test skein, the light green, is laid somewhat apart from the heap, and the examinee is directed to select from the heap, and to place alongside of the test skein, several specimens of the same colour, it may be in lighter or darker shades, but of the same colour. The word green should not be mentioned, and no colour names should be used at any part of the examination; the object being to discover what the examinee sees, and not what he calls it. The examiner may himself set the example, by selecting a few skeins and throwing them aside. The great majority of the examined will proceed with ease and certainty, rapidly selecting the green skeins from the heap, and neglecting all others. It is well to direct them not to touch the test skein, and not to touch any skein in the heap until they have first

selected it by the eye; although they may turn the heap over in order to bring the under ones into view. Presently, someone will look at the standard and at the heap with a more or less wistful and uncertain expression, and then will pick out, perhaps along with true greens, such colours as grays, drabs, and yellows. Either he is more or less green blind, and does not see the element of green in the standard, or he is more or less red blind, and does not see the element of red in the colours which he selects. The fact of his defective colour sense is declared; but the examiner has still to ascertain its nature and its degree. For this purpose the second or diluted purple skein is used. An examinee who matches with it blues or violets is completely red blind; and one who matches with it drabs or greens is completely green blind. One who, although with some difficulty and uncertainty, selects only purples, may be regarded as incompletely colour blind. The chief use of the red skein is to furnish dreadful examples among those persons whose defective colour sense has been ascertained by the earlier tests. The red blind will select as matches dark green or chocolate; the green blind will select bright green or bright brown.

An examinee who selects only greens to match the green may at once be passed as correctly colour sighted; and one who makes faulty matches with the purple should at once be rejected as colour blind. It does not follow that he will confound red and green lights when these are exhibited in immediate succession or side by side; but he will often do so, and he may always be made to do so by a little management. He distinguishes not by colour, but by relative luminosity; and this is an uncertain and untrustworthy guide. The more often he distinguishes correctly, the more certain it is that he will be betrayed into error at last. I have here two different forms of lantern, each so constructed as to exhibit two lights, each of any desired colour, either singly or together, and each light admitting of being transmitted through a larger or smaller aperture, or of being partially veiled by the interposition of smoked glass. With such lanterns those who have been discovered to be colour blind by Holmgren's method may always be made to betray themselves, and to commit errors which would be of terrible significance in the conduct of either railway or marine traffic. To the colour sighted, on the other hand, no changes of this kind are of the least importance, red being always red, and green always green, and any mistake between the two being practically impossible.

Besides the very declared cases, the examiner will meet with some in which he can say no more than that the colour sense is defective; and a question may arise whether the people so described should be called upon to judge of signals. For my own part, and if the question be one of entering railway or marine service, I should say certainly not. The people are not to be entirely relied upon, and they ought not to be employed. No man in his senses would travel by a train or steamer if he knew that the driver in one case, or the look-out man in the other, was of uncertain colour vision. The hardship of refusing such people would be very small, because they are com-

paratively few in number and may find other occupations, while the results of an error arising from their incompetence might be as disastrous to themselves as to others. I would myself reject, on the threshold of railway or marine service, every candidate who selected any confusion colour, any drab, yellow, or gray, to match with the first or green test skein, or who even hesitated and looked twice at such colours before rejecting them.

Considering, however, that the methods of examination employed by many railway companies, and by the Board of Trade for Officers of the mercantile marine, are extremely faulty, and that through them, in all probability, many colour blind persons have slipped into both services, while many colour sighted have been ignorantly rejected, the question of incomplete colour blindness might be somewhat differently regarded if it had reference to the retention in employment of a person who had once been admitted, and who had discharged his duties satisfactorily. It is difficult to estimate the degree in which such a person might have learned to compensate for his defects by increased observation of differences of luminosity, or even of differences of some other kind which might escape the notice of those to whom they were less important; and hence many attempts have been made to devise means of measuring and expressing the degree of the defect. If this could be accurately done, it might perhaps rest with employers to lay down some rule as to the degree of acuteness of colour vision which they would require, and it would then rest with experts to declare whether this degree was reached in any given case. Dr. Holmgren devised an instrument which I have here, and which he called a chromato-skiameter. It consists of a central pillar supporting a lamp, and supporting also two long arms, which extend horizontally at a right angle to each other. One of these arms supports a white porcelain screen, and a slender rod which casts a shadow upon the screen. The other arm supports a sliding mirror, by the reflected light of which a second shadow of the rod is made to fall close to the first. If we interpose a piece of coloured glass between the rod and the lamp, the two shadows will assume complementary colours and will be of unequal luminosity. By placing the mirror at a certain distance from the lamp, their luminosity would be equalized to a colour sighted person, but would still be unequal to the colour blind. The amount of alteration in the position of the mirror, as read off upon a graduated scale, which is required in order tc equalize the luminosity of the shadows for the colour blind, was expected to furnish a numerical statement of the degree of the defect. Our Chairman devised a still better apparatus for the same purpose, in which the luminosity of a patch of colour can be compared with that of a patch of white light, the intensity of which is determined by the size of the revolving sectorial aperture through which it is admitted. Both methods are open to the objection that they require a more cultivated power of observation than a candidate for railway or marine employment would often be likely to possess; and that, however admirable for testing the vision of a philosopher, they would be far less applicable to a clown. I have

endeavoured to devise a method of another kind, with which, so far as I have been able to test it, I am well satisfied. My instrument is here, and it consists of an oblong box, which has at one end an outside lamp and two visual apertures, at the other a slide carrying test objects. These objects consist of groups of dots of different colours, the arrangement of the colours admitting of infinite variety. The light of the lamp is admitted into the box by an aperture, the size of which is controlled by a screw acted upon from without; and a lens is so placed that all the light which enters the box is distributed over the surface of the test object. The size of the aperture may be increased from zero to 1,500 sq. mm.; that is to say, the spots may be flooded with light, or may be left in almost complete obscurity. Now I find that a person of normal colour sense is perfectly well able to distinguish a group of dots, some of which are light red and others light green, and to say which are which, with an illuminating aperture of 4 sq. mm. I have found partially colour blind people who required an aperture of 80 sq. mm. in order to do the same thing; and I have found absolutely red blind or green blind people who could not be made to do it at all. I have used this test apparatus in cases in which colour vision has been impaired by disease; and I have found its indications to correspond closely with other signs of improvement or of deterioration.

The Committee appointed by the Royal Society, after holding many meetings, and receiving much evidence, have arrived unanimously at the following recommendations, which, as I have said, have been transmitted to the Board of Trade, and with which I may perhaps fitly bring this discourse to a close:—

1. That the Board of Trade, or some other central authority, should schedule certain employments in the mercantile marine and on railways, the filling of which by persons whose vision is defective either for colour or form, or who are ignorant of the names of colours, would involve danger to life and property.

2. That the proper testing, both for colour and form, of all candidates for such employments should be compulsory.

3. That the testing should be intrusted to examiners certificated by the central authority.

4. That the test for colour vision should be that of Holmgren, the sets of wools being approved by the central authority before use, especially as to the correctness of the three test colours, and also of the confusion colours. If the test be satisfactorily passed, it should be followed by the candidate being required to name without hesitation the colours which are employed as signals or lights, and also white light.

5. That the tests for form should be those of Snellen, and that they should be carried out as laid down in Appendix VI. It would probably, in most cases, suffice if half normal vision in each eye were required.

6. That a candidate, rejected for any of the specified employments, should have a right of appeal to an expert approved by the central authority, whose decision should be final.

7. That a candidate who is rejected for naming colours wrongly, but who has been proved to possess normal colour vision, should be allowed to be re-examined after a proper interval of time.

8. That a certificate of the candidate's colour vision and form vision according to the appointed tests, and his capacity for naming the signal colours, should be given by the examiner; and that a schedule of persons examined, showing the results, together with the nature of the employments for which examinations were held, should be sent annually to the central authority.

9. That every third year, or oftener, persons filling the scheduled employments should be examined for form vision.

10. That the tests in use, and the mode of conducting examinations at the different testing stations, should be inspected periodically by a scientific expert, appointed for that purpose by the central authority.

11. That the colours used for lights on board ship, and for lamp signals on railways, should, so far as possible, be uniform; and that glasses of the same colour as the green and red sealed pattern glasses of the Royal Navy should be generally adopted.

12. That in case of judicial inquiries into collisions or accidents, witnesses giving evidence as to the nature or position of coloured signals or lights should be themselves tested for colour and form vision.

Rear-Admiral BOWDEN-SMITH: The lecturer has called our attention to the necessity of efficient eyesight in those persons who have to do with signals, not only as regards plain sight, but as regards colours. He pointed out the fact that the Board of Trade have recently given orders that Officers should be examined with regard to colour blindness, and we know that some Officers in the mercantile marine, who have got up nearly to the top of the tree, have lost promotion to the rank of Captain through the discovery late in life that they were not able to distinguish colours. I happen to have been for many years on the Committee of the Marine Society. We always try to have an average of 200 boys on board of our training ship the "Warspite," and as we only keep those boys on board nine months before they are drafted into the mercantile marine or into the naval training ships, you will understand that a considerable number of boys pass through our hands. Since the agitation has been set on foot about colour blindness, we have instructed our medical Officer to examine these boys very carefully, not only as regards efficient eyesight, but that they should know their colours. Since those instructions have been given, for some three or four years, we have noticed that about ten per cent. of the boys who come to us are rejected as having defective eyesight, or because they are colour blind. The boys we get in the Marine Society are mostly destitute boys. Some are taken from the streets and some from the workhouses, but there is also a considerable number of a better class. My idea is that these boys are not colour blind at all, but that they are "colour ignorant," that is, they have never been taught their colours. Sometimes we examine a rejected boy in the committee room, and we ask him the colour of the table cloth, which is red, and which he would probably call "green;" but with some it has been found that after a month or two they can be taught their colours, and are thus enabled to pass in. I should like the lecturer to tell us by-and-bye if he ever came across a really educated person who did not distinguish colours. I daresay there may be such persons, just as with regard to music there are people who do not know one tune from another, I daresay there are some people to whom you might sing "Ta-ra-ra boom-de-ay," and they would not know it from "God save the Queen," but I have never known any one really educated who was colour blind. The lecturer has given us instances which he has heard of, but I do not understand whether they have come under his own notice. These boys that we have had to do

with are mostly poor boys, and have not been properly educated. Mr. Brudenell Carter has referred to the red and green lights on the railway and on board ship. These are really the only coloured lights we have to deal with, and, perhaps, it would be interesting to the audience to know why they are the only colours available. The reason is, that they are the only colours you can get to carry any distance. You all know that steamers carry a white light at the fore-mast head, and a starboard green light, and on the port side a red light. They show, however, no fixed light astern, and it has been proposed that ships over a certain size should carry such a fixed light. Often at sea we see so many white lights, especially in crowded waters, that at first sight it would appear desirable that this stern light should be some special colour. When, however, we come to look into the matter more closely, we find that we cannot use any other coloured light, and for this reason, that there are no other colours easily distinguished from red and green, which will show any distance. Some years ago I witnessed some trials at Shoeburyness, by the kind permission of the Board of Trade, and there we tried, amongst other colours, light blue, and a mauve or purple, and a yellow and orange. At a short distance the mauve or purple looked exactly the same as the red light. The light blue does not carry for any distance, and the yellow, if a pale colour, is easily mistaken for the ordinary white light; if a deep orange it can be mistaken for the red; in fact, the only colours that it seems possible to use for signals are red and green, and that I presume is the reason why railways and ships use those colours and no others. Now on board ship these red and green lights are only supposed to be visible for 2 miles, and it was said by many gentlemen at the late Maritime Conference at Washington that now that we have fast steamers, going 18 or 20 knots, a side light showing only 2 miles is ridiculous, and that the range ought to be increased to 5 miles; but you cannot get coloured lights to show 5 miles unless at a greatly increased cost. The fact of the matter is, that with these coloured lights and the thick glass that you have to use to bear the shock of the sea, it is calculated that from 70 to 90 per cent. of the light is lost. The German, Austrian, and American delegates had tables with them, showing the amount of loss, but as they did not quite agree in their figures, I cannot give you any definite percentage of the loss, but it ranged from 70 to 90 per cent., and that shows you how very difficult it is to get even a red or green light to carry for any considerable distance. The lecturer told us that in the Navy there are good regulations by which not only our Officers, but also the men, are tested with regard to eyesight, and I hope it is so. But I will give one instance of a case which occurred to me only some few years ago, to show how even the best doctors can be deceived. It was not a matter of colour certainly, but it is an interesting fact. My last command was the "Britannia," before I got my flag. We have a good many servants, of course, having a large number of cadets, and a letter was written to me from home asking me if I could take a young lad as servant, if there was a vacancy. I knew the lad, he had waited upon me at home, he was a very smart fellow, and I offered to take him. My people further informed me, however, in case I had not observed it, that the boy had a glass eye. I sent for the medical Officer, and said, "Here is a boy I want to enter very much as a servant; he is a very smart boy, but he has a glass eye; perhaps you won't like to enter him." "Oh, no," he said, "I cannot possibly enter him, it would be against my instructions." "Well," I said, "you wouldn't have known it if I had not told you;" and I gave it up. Ladies and gentlemen, I told you that he was a smart boy, but he was a much smarter boy than I took him for—he left my brother's service and went to Portland, where we have a training ship. He presented himself for entry as a servant, without saying a word about the glass eye. He was examined and entered, and they never found it out, and, I believe, he is at present doing very well indeed as a steward, in spite of his having only one eye.

Mr. BEATTIE-CAMPBELL: I should just like to endorse what Admiral Bowden-Smith has said with regard to red and green being practically the only two easily distinguishable colours for any distance at sea. Some years ago, on the Grand Trunk Railway of Canada, it was thought desirable to make some change in the signal lights. It was supposed that the engine drivers could not distinguish accurately between the green and red sometimes. A purple light was, therefore,

tried as an experiment instead, but it had to be withdrawn. It would not answer at all. This bears out what the Admiral has just told you. The fact that the drivers were not always able to distinguish the red and green lights, may have been from different atmospheric causes, or, perhaps, even the men were not at all times quite in the same condition themselves.

Captain O'CALLAGHAN: I rise for the purpose of asking some explanation from the lecturer on one point—an explanation which I have no doubt he will give satisfactorily. But, before I do so, I would ask to be allowed to make a remark on the subject of red and green signals. Those who have given much consideration to the subject are aware that a large proportion of colour blind people cannot distinguish red from green, and it is also ascertained that there is hardly anyone not absolutely colour blind who mistakes red for blue. Admiral Bowden-Smith has told us of the difficulty of getting colours which can be seen at a long distance, and also that blue may be mistaken for green; but I do not think it can be mistaken for red; and as for the question of luminosity, I suppose that may be obtained at a greater distance by the use of stronger lights, or possibly lighter coloured glass. I have taken every opportunity—and I have not had many—of suggesting that signals both for land and sea should, if possible, be red and blue rather than red and green, because the two former are not liable to be mistaken to anything like the same extent as the two latter. The question I would ask is this: we are told in some scientific works, as well as in the lecture to-day, that impressions on the retina may be classed as red, blue, and green; but the common theory of colours, given as the three primary colours, blue, red, and yellow, and we are told that from these all the others can be produced. Now I do not think that applies to red, blue, and green, because no combination of red, blue, and green, or any two of them, will give us yellow, whereas blue and yellow mixed will give us green. I hope the lecturer will favour us with an explanation of the difference between the two theories—the one, which is given in some scientific books, and the other, which appears, perhaps wrongly, as the more simple and the more practical. We are taught that if a disc is divided into blue, red, and yellow in certain proportions, and made to revolve rapidly, it will appear white or nearly white, and that its not being quite white arises from impurity in the colours; but I do not think that will apply if we get red, blue, and green. We know that green may be produced by blue and yellow, and we also know that yellow cannot be produced by any mixture of any other colours. I may now, with your permission, advert to certain external indications of colour blindness of which I have had some remarkable instances. When I was at the School of Musketry at Hythe, one day after dinner the discussion turned on the question of colour blindness. An Officer who was present said he had a defect in his perceptive faculties, and he wished to know if anyone could tell it. I told him I could not tell simply by looking, but if he would allow me to examine him I would endeavour to tell him. I found a marked depression over the eye, which is by many associated with imperfect development of the colour sense, and I told him I was certain that there was some defect in his perception of colours, though I could not tell to what colours it extended. He informed me he could not tell red from green. He said he could not notice the red blossoms of clover—that if bright green and bright red objects were placed side by side he could see that they were not quite alike, but he could not decide which of the two was the red. Whilst I was an Adjutant of Volunteers a man came into the headquarters of the corps, and on examination fulfilled all the necessary conditions. As he left the room I said to the sergeant-major, "That man is colour blind." The following summer I happened to be in the same compartment of a railway carriage with this man, going to the range. I said to him, "Don't you sometimes find a difficulty about colours?" "Oh," he said, "I know nothing about colours; I am obliged to ask my wife the colour of everything." I could multiply these instances almost indefinitely as showing a connection between a certain external defect and the inability to perceive certain colours.[1]

[1] Some combinations of the prismatic colours shown by the Chairman after the lecture did not support the statement of the primary colours being red, blue, and

Mr. BICKERTON: I find some considerable difficulty in rising to address a few remarks to you, and from two reasons. The first is, that Mr. Brudenell Carter has such a facility and felicity of expression that most people who follow him must be at a disadvantage, and the second reason is, that he is such a master of his subject that it is impossible for anybody to cavil at any remarks he has made upon the physiological aspects of colour blindness. But I may be allowed, perhaps, to dilate upon his remarks on the practical aspect of this subject and to give you some reasons why the conclusions of the Committee of the Royal Society were necessary. In the first place, we, the medical profession, Mr. Brudenell Carter, and others, believe that a very large number of the accidents and collisions that take place at sea are directly due to colour blindness and defective sight on the part of the look-out men and Officers. This has been exceedingly difficult to prove, and for many reasons. The men themselves object to being examined; the Officers will not be examined; the ship-owners will not admit for an instant that any of their men have defective vision, and when collision cases come before the Board of Trade, up to quite recently, the colour question has been entirely left in the background. It is necessary, therefore, to try to prove why we think that these collisions are due to some extent to defective sight and colour blindness. The American Board of Trade mentions that from the year 1859 to 1866 there were 2,408 collisions. Accidents which it was impossible to avoid accounted for 1,562. Errors of pilot or Captain accounted for 215. Want of proper interpretation of rules of the road accounted for 537. Undetermined causes accounted for 94. Therefore, of the 2,408 cases, at least 846 might have been due, I do not say they were, but might have been due, to colour blindness or defective vision. If we take the Wreck Register for 1887, of 1,263 accidents the English Board of Trade makes "causes unknown" account for 209. Now, with regard to these accidents from unknown causes, we not unfrequently read remarks like the following, and I quote this from the "Times" of February 5, 1889. The "Times" was commenting on the terrible accident that occurred in the Channel, when the "Nereid" and the "Killochan" ran into each other, and in less than five minutes went to the bottom, carrying down twenty-three men out of forty-two. The remark was as follows: "All enquiries respecting the cause of this disaster lead to the same conclusion, that it was due to one of those astounding errors of judgment on the part of one or other of the navigators which seem to defy all attempts at reasonable excuse. Each blames the other." But read in the light of our knowledge, and we have a simple and natural explanation of a mysterious and unaccountable collision, and so long as colour blind and defective sighted men are tolerated in the mercantile marine, just so long may we continue to read of "mysterious and unaccountable" disasters. It is not as if this argument of ours is anything new, for as long as ninety-eight years ago, in 1794, Professor Wilson, of Edinburgh, in speaking of these accidents, wrote the following prophetic sentence: "The appalling yearly list of lost vessels which appears in our wreck returns awakens the suspicion that more than one of these fatal disasters may have resulted from the mistaken colour of a light-house, beacon, or harbour lamp, which, on a strange coast and with the accompaniments of a snow storm or a thick fog, has been wrongly deciphered by a colour blind man." All are well aware of a case which occurred in America, in which it was practically proved that a collision, in which ten lives were lost, was due to the pilot being colour blind, the error being that he mistook the green light which he saw ahead of him for a red light, and ported. The consequence was, he ran clean into the vessel he wished to avoid, and sank her. I myself feel inclined to the belief that if the Officer on board the "Nereid" was examined, he might be found to be colour blind. This collision between the "Nereid" and "Killochan" was followed by a very long correspondence in the "Times," by Admiral Colomb and various other eminent and distinguished naval authorities, who gave all sorts of reasons why the accident should not have occurred, but they did not give one single reason why it should have occurred, except that the man ported the helm when he should not

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green, but rather confirmed the commonly received theory of their being blue, red, and yellow. A combination of blue and green did not appear yellow, but light green, and blue and yellow together appeared green, and not white.—E. O'C.

have done so. That is the origin of most accidents, I take it. And mind you, this accident between the "Nereid" and the "Killochan" occurred on a perfectly clear night, and the two vessels had had each other in view for some time. The remarks I have made may be applied also to the collision between the steamships "Douro" and "Yuruac Bat," which came to grief on a perfectly clear night, more than two score people being drowned. In regard to the "Toronto" and "Freidis" collision occurring in the Irish Channel, it is interesting to notice that the Captain, two Officers, and the Quartermaster said that a certain light they saw was red. The look-out man said that there was no red light, that it was a green light, and being asked by the Justices what was the cause of the accident, he said that it was owing to his own Captain porting his helm. In a letter published and commented upon in the leading Liverpool shipping paper, the "Journal of Commerce," referring to this case, it is remarked that "the negative evidence of the look-out man, that he did not see the red light, cannot weigh against the positive evidence of the Captain, two Officers, and the Quartermaster, that they did see it, and it has yet to be ascertained why it was not seen by him." In this remark I agree, for, although there is no evidence that he was colour blind, neither is there any evidence that he was not. Common sense would say, "Have the man tested;" but the wiseacres who adjudicate these matters do not consider such matter-of-fact methods necessary, and are content to ask the question, Did any one ever know a sailor who acknowledged himself colour blind? In the above case, the Court took the opinion of the irresponsible look-out man, reprimanded the Officers, and took away their certificates for a time. In the collision between the "Romulus" and "Belgrano," where, on a perfectly clear night, two steamers ran into one another, the conflict again was the question of lights. On this subject a great number of our naval authorities still seem as if they will not admit the possibility of imperfect vision and colour blindness causing disaster. One of these gentlemen is Admiral Colomb, and he has, in my opinion, done much harm, and has been a great power in preventing this subject of colour blindness of sailors receiving the attention it deserves. In the course of an able paper delivered by him on the subject of the Washington Maritime Conference, at the Society of Arts, and reported in the "Times" of March 28, 1890, he made the following statement: "As to the qualifications for Officers and seamen, the Conference (Washington) dealt wholly with the question of colour blindness on account of its danger with reference to the red and green side-lights. He never knew, himself, a case of collision where colour blindness was in question. The statements were generally perfectly clear that wrong helm was given deliberately in the face of the colour seen, and as no authoritative teaching had existed to show that it mattered what colour was seen so long as danger was denoted, he had never been able to lay stress on the colour blind question." Mr. Baden-Powell, R.N.R., who followed in debate, declared "that in all cases of collision at sea, there was no default of the rule of the road at sea, but they generally arose from negligence. The rule of the road at sea was perfectly well understood by intelligent men, and it was the 'lubbers' and the careless who did not act according to it. Admiral de Horsey considered collisions at sea were caused principally by three faults—a bad look-out, ignorance of the rules, and neglect of the rules." In opposition to the opinions of these eminent gentlemen, I will quote the opinion, in which I fully agree, expressed by a gentleman who wrote to the "Liverpool Daily Post" in the following terms: "Is it reasonable to believe that steady married seamen, with families depending on them, and who have had years of experience, suddenly lose all judgment and common sense and steer their vessels on clear nights, sometimes in broad daylight, so as to deliberately ram each other, thereby losing their lives and ships and the lives of the passengers? Surely not. In none of the other professions and callings can we find anything approaching a parallel case. Therefore, in some cases their eyesight might be defective." The "Times" has stated that the primary cause of casualties at sea, like those by road on shore, is either the reckless selfishness of Officers in command, or the absence of a proper look-out. The first of these said causes I am not prepared to discuss, but that the second accounts for a very large number of disasters no one who reads carefully the Board of Trade inquiries can deny, and I do not think I am presumptuous in believing that so long as the possi-

bility exists of colour blind men being chosen to act as look-outs, no diminution in the number of shipping disasters can be expected. It was all very well in days gone by, when ships jogged along at 5 or 6 knots an hour, but it is a very different thing now, when ships are going 15 or 20 knots. Then, when a light was sighted, there was time for half a dozen men to look at it; now, no sooner is a light seen on the horizon than it is passed, and unless a man has a perfect vision, both for form and distance, he is sure to come to grief sooner or later. The Royal Commission which sat recently on the loss of life at sea, in one of its conclusions made the remark that "it was the duty of shipowners to select competent men and Officers." Now I ask what more incompetent men could be shipped than defective sighted men and colour blind men? It is a fact, as Mr. Brudenell Carter has told us, that there are 3½ or 4 per cent. of the whole male population colour blind. It is also a fact that 8 per cent. of the total population suffer from some refractive error. It is a fact also that a certain proportion of sailors suffer from blindness due to disease of the eyes, and yet these men are shipped and not the slightest notice taken of their vision. This Commission made the remark that it was the duty of the shipowner to see that the men were competent. In that remark I do not agree. I do not think it is so much the duty of the shipowner. It is the duty, and one of the first prerogatives of the Legislature, that it should provide for the safety of its subjects, and it is the Legislature's business to see that sailors who are allowed to be look-out men, and to whom they give certificates for masters and mates, should be thoroughly competent. Knowing that there are a large number of accidents due to "unknown causes," are we therefore unreasonable in thinking that some at least are due to defective vision and defective colour sight? I should like to mention a few cases. I know a case of a man at the present moment who has been operated upon for cataract, and who is in command of his vessel. He can scarcely see a haystack passing along the road without his glasses. Is he a competent sailor? Possibly this cataract case is the one mentioned by a gentleman who was on board the "Warrior," and who, in writing to me, said: "I am collecting evidence of colour blindness and defective sight, and in my humble opinion defective vision is more prevalent than is at all supposed. Why I once lodged with a sea captain who had lost his vessel in collision with another, and I soon found that he was almost blind, though to a casual observer he appeared to see well." I mention the following case of colour blindness in a boy, not on account of the colour blindness, but for another reason. The lad is green blind. He had been to sea for four years; he was then sent to a coach, who said he was colour ignorant, and that he was quite able to carry on his sea profession. I mention it because the father, whom I have not examined, was in command of a vessel which came into a very terrible collision, and caused the loss of a great many lives some years ago. Seeing that the son is colour blind, the father may be in a like condition. The following case, related in the lad's own language, shows well the dangers run in employing short-sighted sailors: "On the last voyage I found, when steering the ship close hauled to the wind, I could not see the clew of the royal properly. I never did regular steering before that voyage. During the first voyage I did no look-out duty, but during the last I have done regular look-out duty. When my companions were able to see a ship on the water and the sail she was carrying, I could just see a speck, that it was a vessel and no more. When steering and unable to keep the vessel up to the wind, I was spoken to by the master in such terms as, 'You are asleep, and you are dreaming and not attending to your work.'" The lad wanted to give up the sea. He was apprenticed to some shipowner for five years. I wrote a certificate, and told the shipowner he was totally unfit to go to sea. The lad had paid 20*l.* or 30*l.* to be apprenticed. He had only been two years and ten months in his apprenticeship, but the shipowner, to his disgrace be it said, refused to refund any portion of the money, and compelled him to remain on board the vessel. The next case shows clearly the dangers run, and proves our statement that there are colour blind men at sea. I quote now from the "Liverpool Daily Post" of December 4, 1888. "Sir,—Having seen in your issue of the 14th an article on Colour Blindness, I beg to state my case, which I consider a hard one. After serving as apprentice

for four years with Messrs. T. B. Royden and Sons and J. B. Walmsley and Co., and afterwards as A.B. in steamships, I prepared myself for the Board of Trade examination, but failed in colours. To use a nautical phrase, I am thrown on my beam ends, for I have now been two months ashore without being able to obtain a land situation. I write this hoping it will prove a warning to all young fellows about to enter on a sea life, not to do so until they have first had their eyesight tested, also hoping it may meet the eye of some gentleman who could help me to a situation, which I am very much in want of. Unless I can hear of something I shall have to go to sea again in order to support myself. Yours truly, R. P. THOMPSON, 44, Tintern Street, Walton." Nearly twelve months later I wrote to this gentleman, and received the following reply:—"August 10, 1889. I am going to sail to-morrow in the s.s. 'X——,' for Rio de Janeiro, and expect to be away about three months." Comment is unnecessary. I have said quite sufficient to show that there are a number of colour blind and defective far-sighted men in the mercantile marine, and that a great number of accidents are due to colour blindness and bad far-sight. With regard to the case mentioned by Admiral Bowden-Smith of the lad with the glass eye, I would like to say this. The Board of Trade did pass a regulation that a man who had a glass eye or a man who had lost an eye could not be a sailor. I wrote to the Board of Trade and asked whether they would have sent Nelson about his business. I do not know whether that had any effect at all—it is very difficult to have any effect on the Board of Trade—but I remember shortly after a regulation was passed that even if a boy had lost one eye if the other eye was perfect he might be a sailor. It might possibly account for the young gentlemen spoken of entering the Service. Lord Hannen in giving judgment in a case of a vessel overtaking and running into another said "a good look-out was not kept on board the 'Essequibo,' but it is to guard against the *defects not merely of mere sight* but of their minds and attention that rule was passed." This shows the Judge evidently thinks that men who are in command of vessels have good sight. I venture to think Lord Hannen gave credit where it was not due. The framers of the rule of the road at sea, scarcely believing in the existence of colour blind sailors, and not at all in short-sighted and blind sailors, cannot have appreciated the dangers of employing either, nor, I venture to think, would their successors be in any more enlightened condition were it not that Dr. Farquharson's action in the House of Commons has been the means of directing public attention strongly to them.

Admiral BOYS: I should like to corroborate what Admiral Bowden-Smith has said about the colour blindness of boys, who are medically examined for the Marine Society's training ship "Warspite." I think more rejections arise from ignorance of the names of colours than from actual colour blindness. With regard to accidents from collisions there is a cause for some collisions which may have been attributed to colour blindness, and which has happened within my own knowledge, viz., that the red and green lights have been transposed, and put on the wrong sides of ships. You can imagine that in the confined space of the forecastle of a merchant ship, where the lamps are lit and trimmed, by accident or carelessness, it happens that the green light is put into the red box and the red light into the green box. I believe that has been the case in some collisions, which have been put down to colour blindness or other causes.

Mr. BICKERTON: I should just like to say that the Board of Trade have never taken any notice of this question of colour blindness in inquiries held until the last few weeks, when, in the inquiry held with regard to the stranding of the "Violet," the Justices said: "There is one circumstance which the Court wishes particularly to call attention to. After the close of the inquiry, and the respective certificates had been given up in the usual way, it was subsequently found that the mate's certificate bore the memorandum in red ink, 'This Officer has failed to pass the examination in colours. (Signed) J. CLARK HALL, Registrar-General.' On the face of it, and without some explanation, it seems a most undesirable and reprehensible thing that a master's certificate should be granted to a man who is apparently unable properly to distinguish colours. The danger of entrusting the command of a vessel to such a man is too obvious to need further comment. And, assuming that a correct register of certificates granted be kept, then the Board of

Trade's solicitor conducting the inquiry should have been instructed on the point, in order that he might bring to the notice of the Court the fact, as, under certain circumstances, it might have had an important bearing upon the subject of the investigation." It is the first time that the Justices appointed by the Board of Trade have ever, in any judicial inquiry, taken any notice of colour vision, and the condemnation of the Board of Trade by their own representatives is well warranted and well deserved, and I hope all interested in the subject will make every use of this quotation, for it deals a death-blow to the existing regulations, and to the masterly inactivity of the Board of Trade on this subject.

Admiral BOWDEN-SMITH: My boy that got in with the glass eye had nothing to do with the Board of Trade—he got into the Navy.

Mr. BRUDENELL CARTER: I have very few words to say in reply to the questions which have been asked me. Admiral Bowden-Smith appeared to attribute all colour blindness to ignorance, and inquired whether I personally knew instances of colour blindness in educated people. I know myself two Fellows of the Royal Society who are unable to distinguish red from green, and who state that they cannot tell the different railway lamps one from another. A lady of title wrote to me the other day giving me pedigree illustrations of colour blindness in her own family, which had come down through three or four generations. It is impossible to distinguish between colour blindness and colour ignorance when names are used. To ask a boy the name of a colour, throws no light whatever upon the defect of his colour vision, and nearly half the mistakes made by imperfect methods of examination have been due to the introduction of nomenclature in inquiries in which nomenclature had no bearing whatever upon the facts. The question of attempting to use different colours for signal lights has been investigated again and again, and in the report of the Royal Society Committee, Captain Abney has given the luminosity as intercepted by various coloured lights, and has shown that blue is wholly unsuitable for the purpose. He has shown that we are practically tied down to red and green, and that to take any different colours would be to sacrifice the great majority of the colour sighted to the very small minority of the colour blind. Captain O'Callaghan has not quite, I think, followed the recent developments of the constitution of light and colour. Our Chairman will be so kind, I think, as to show upon the screen the yellows produced by the mixture of red and green, and I daresay he will be so kind also as to show that not green, but white, is produced by the mixture of yellow and blue, yellow containing the red and green. A different effect takes place in the paint box, but that depends on a wholly different principle, one which is very easy of explanation, but which would take up too much of your time if I were to attempt to explain it now. As a matter of fact, the primary colours are red, green, and some shade of blue, and by the combination of those three, white can be produced immediately. By the combination of red and green the various shades of orange and yellow can be produced, according as one colour or the other predominates. I do not think any further questions have been asked me. I can only return you my thanks for your kind attention.

The CHAIRMAN (Captain Abney): It is my duty to sum up the discussion. There was one remark that Mr. Brudenell Carter made during his lecture to the effect that we had not yet been able to find a thoroughly investigated case of a man who saw only in one colour. I have been the happy examiner of three such cases. I know of two brothers who certainly only see mono-chromatically, and the sensation they have is that of violet. Only yesterday and the day before, owing to the kindness of Mr. Nettleship, a patient was sent to me to examine, and I had the satisfaction of finding a case whose vision was also mono-chromatic. He could see but in one colour, and his was a green sensation; both the red and the blue sensations were absent. In the other case the green and the red sensation were absent. I look forward to the time when a patient will be found in whom the green and blue sensations are absent, and who will see with the red sensations alone. We shall then have three distinct types of mono-chromatic vision which, if combined together, would give normal vision. I thought it might interest the meeting to see the matches which the green mono-chromatic vision patient made. Skeins of a variety of colours of Berlin wool all proved to appear to him of the same colour when put in a heap. When asked "Is there any difference between them?"

the patient said, "There is no difference at all except that some are darker than others: they are all of the same colour." This patient is a very good example of passing into the mercantile marine without proper colour examination. He was on board the "Conway" training ship, and was passed by a medical Officer as having proper colour vision. The medical Officer does not seem to have known very much about colour testing, for he got three pieces of silk from his wife, and told him to tell him the names of the colours. The boy was cute enough to name correctly enough the red, green, and whatever the other colour was. He was passed as all right. He was next shipped as an apprentice on one of the White Star vessels, and in nine months more he would have completed his apprenticeship, and then would have gone up for a certificate as mate. He happened, however, to be on a voyage in the Pacific, and was on the look-out when a vessel chanced to be sighted in the distance. He called to the Officer on the bridge, "Green light ahead!" The Officer immediately took his telescope and said, "No, my lad; it is a red light." "Oh, no, sir; it is green." The Officer told him he must be colour blind; but the lad informed me he thought it was the Officer's sight which was in fault. Naturally he was never allowed to go on the look-out again, and when he came back he was examined by Mr. Nettleship, who found him absolutely colour blind. Yesterday I examined him, and I found, as I have stated, that he had only mono-chromatic vision. No wonder he mistook the signal light, for any colour would be the same to him. His is a hard case, for he had passed through a training ship undetected, and was very nearly fit for passing his examination as mate. I have not the slightest doubt he would have been rejected as regards the colour test, even by the Board of Trade at the present time, as the defect was so very glaring. Still it shows the necessity of having a really good test previous to a boy entering upon a career of that description. With regard to the suggested use of a blue light for signal lamps, it is impracticable. If a blue glass were employed which was sufficiently coloured to appear blue and not white, when an oil light is behind it, it would cut off at least 95 per cent. of the light in a clear atmosphere, and in a fog a great deal more. Even the Navy red glass which is used cuts off 90 per cent., and the green glass from 50 to 75 per cent., and these will carry much further in a fog than the blue. I am not at all surprised at the experience of Admiral Bowden-Smith about the mauve glass which appeared to be red when it got to any distance. The atmosphere if at all turbid will cut off a great deal more of the blue rays than the red. The consequence is the blue from the mauve disappears, and the red is left behind. There have been a variety of stupid suggestions made from time to time in the public prints with regard to making a change in the colours of signals. There is one gentleman who ought to have known better, one of the medical profession, who writes and recommends that the signals should be orange and blue for certain theoretical reasons, which, by-the-bye, are open to more than a good deal of doubt. Now orange in the spectrum you cannot distinguish from the colour of an oil light. A blue light, as I have told you, is absolutely inappreciable, on account of the small luminosity it has in foggy weather. Therefore the suggestion that orange and blue could be employed must be dismissed as worthless. The quality of the green glass, it seems to me, is, however, of the greatest importance. With a yellow-green light anybody who is even slightly colour blind might mistake the light coming through it for a white at some time or another, and it may be that an accident will occur through its not being suspected. A proper shade of green to employ is that which is used in the Royal Navy, and I believe to be the best signal glass which can be used. I was surprised to hear Admiral Bowden-Smith say that boys are rejected not only for colour blindness, but also for colour ignorance.

Admiral BOWDEN-SMITH: For eyesight altogether.

The CHAIRMAN: The question of colour ignorance does not enter into the Holmgren test at all. We have it on evidence before the Committee of the Royal Society that colour ignorance is not unknown in some districts of England. Yokels from these parts may be absolutely unable to tell the names of colours. Of course that is a defect which can be remedied by tuition. They can eventually learn the names of colours, but colour blindness is absolutely incurable. You will at once understand that colour ignorance does not enter into the test for colour blindness when

matches of colours are made and the naming of colours required. Of course they might make a mistake, but the examiner would see at once whether it is due to not understanding or to real colour blindness. The way in which a patient treats the heap of wools is a great aid to the examiner. For instance, the day before yesterday I had a patient who was put through the Holmgren test. He did not pass it for the sole reason that he hesitated in making his matches. He picked up the wrong colour to match with a green and set it down again, but he again picked it up and again rejected it, and though he made correct matches in the long run, after a vast amount of hesitation in some few instances, yet I rejected him. I next examined him by the spectrum test, which is infallible, and at once confirmed the diagnosis one had made with the Holmgren test. Such kinds of facts indicate, I think, that the recommendation made by the Royal Society Committee that the Holmgren test should be employed is a very sound one, and one which cannot be gainsaid. As regards the necessity of efficient colour testing, I may say that Mr. Brudenell Carter really set the ball rolling. In a series of lectures that he gave some time ago at the Society of Arts, the whole question of colour blindness was brought forward most ably. The seed sown by those lectures seems to have taken root and fructified. New methods and new theories have since then been brought forward, all helping forward what Mr. Brudenell Carter had in view. Finally, the Board of Trade, in response to Mr. Brudenell Carter's persistency, asked the Royal Society to appoint a Committee to consider the whole question. This, I am glad to say, has been done, and the Committee has reported. Both of us are on that Committee, and I can only add that Mr. Carter has given most efficient assistance to it, owing to his thorough practical knowledge of the subject. I am sure I shall be quite right in asking you to pass a vote of thanks to Mr. Brudenell Carter for his lecture to-day.

SPECIAL GENERAL MEETING.

June 27, 1892.

FIELD-MARSHAL HIS ROYAL HIGHNESS THE DUKE OF CAMBRIDGE, K.G., &c., &c. (President), in the Chair.

THE Secretary (Captain Burgess) read the notice convening the meeting.

The Secretary then read the report of the Special Committee as approved by the Council at their meeting on the 20th June, as follows:—

REPORT OF A SPECIAL COMMITTEE *appointed by the Council of the Royal United Service Institution, on the 31st May, 1892, for the purpose of drawing up a statement of the circumstances under which it is proposed to transfer the Institution from its present to new premises in Whitehall.*

Committee.

General G. ERSKINE, V.P., *Chairman.*

Field-Marshal SIR J. L. SIMMONS, G.C.B., V.P.
Admiral SIR E. FANSHAWE, G.C.B., V.P.
Admiral H. BOYS, V.P.
General J. T. WALKER, C.B.
Lieutenant-Colonel T. H. BAYLIS, Q.C., V.P.
Captain W. H. FAWKES, R.N.

The Committee assembled on the 9th June, 1892, and by adjournment to Thursday, 16th June, and having given due consideration to the subject referred to them, now submit to the Council the following statement:—

The present premises of the Institution consist of two houses, which are the property of the Crown, the Institution being merely a tenant at will. In 1871 it received notice to quit, and, although the removal was not then enforced, it became thenceforward the anxious endeavour of the Council to find suitable accommodation elsewhere. In this they were unsuccessful until 2nd December, 1890, when the Queen was graciously pleased to grant to the Institution the use of the Banqueting House, Whitehall, as a mark of Her Majesty's appreciation of the usefulness of the Institution in connection with the Naval and Military Services. The value of this grant was very great, but as the conditions on which it was made precluded the possibility of adapting the building to meet all the requirements of the Institution, the Council represented to the Government that additional accommodation would be wanted, and that this might be obtained by utilizing the site of Dover House Stables, which is Crown property, and adjoins the southern end of the Banqueting House. Since that time there has been an interchange of communications between the Council and the Treasury on the subject, but no definite arrangement

was arrived at until the 25th May, 1892, when the Chancellor of the Exchequer stated in a letter to the Chairman of the Council that the Institution might have a building lease of Dover House Stables for eighty years at a rent of £350 for the first year and £580 afterwards, subject to the Office of Works having control over the design of the building. This statement of the terms on which the Institution could obtain the site of the stables was accompanied by a repetition of an intimation which had been previously made, that the present premises of the Museum of Practical Geology in Jermyn Street might become vacant, in which case they might be allotted to the Royal United Service Institution. The Council had thus to balance these two alternative schemes for housing the Institution, the one against the other.

It was found that in respect of the cost of maintenance, which would in each case have to be met, there was a difference in favour of the Jermyn Street scheme, but nevertheless, after mature consideration, the Council came to the conclusion that the preponderance of advantage was on the side of the Whitehall scheme; the reasons which led to this view being:—

1. The locality in which the Banqueting House is situated is one of the best in the metropolis, and in every respect preferable to Jermyn Street.
2. The beautiful façade of the buildings and the historical interest which attaches to it, although of course not essential to the prosecution of the work carried on by the Institution, would nevertheless conduce to its prestige, and on that account should not be overlooked.
3. Possession can be obtained of the Whitehall premises at once, whereas in the case of the Jermyn Street building, it has been ascertained that the Geological Museum may not be removed from it for an indefinite period, and meanwhile some unexpected difficulties may very possibly arise which would interfere with the claims of the Royal United Service Institution to occupy the building on its becoming vacant.

On referring to the annexed paper (B), which shows the estimated cost of carrying on the administration of the Institution in the event of the Whitehall scheme being adopted, it will be observed that there will be an annual deficit of £792. It therefore becomes necessary to consider what prospect there may be of increasing the funds sufficiently to make the two sides of the account balance each other. It has been suggested that a source of income might be derived from instituting a charge for entrance to the Museum, but the proceeds of such a charge might not be more than enough to cover the extra cost of keeping up the Museum in a greater state of completeness than that in which it has been for some time past, owing to the uncertainty of the position of the Institution.

There is, however, good reason to hope that when adequate accommodation has been procured, and all the improvements in the administration of the Institution, which are at present in contempla-

tion, have been brought into operation, there will be an accession to the number of its members, and that the consequent increase of subscriptions would remove all difficulty in defraying the additional expenditure which would result from the change of premises. When it is borne in mind what a large number of names there are on the active and retired lists of the Navy and the Army, including the Auxiliary Forces (about 32,000 in all), it must be admitted as strange that not more than some 4,000 Officers have considered it their duty or privilege to be members of an Institution from which both Services have derived the greatest possible benefit.

(Signed) GEORGE ERSKINE, *Chairman.*
16*th June*, 1892. (On behalf of the Committee).

Appendix A.—Rates and Taxes in present and proposed Buildings.
" B.—Estimate of Expenses, Whitehall Scheme.
" C.—Estimate of Expenses, Jermyn Street Scheme.
" D.—Estimate for Removing.
" E.—Estimate for New Building.
" F.—Funds of Institution.
" G.—Schedule of Accommodation.

A. RATES AND TAXES.

PRESENT BUILDING.

Valuation ..... { £700 gross. £584 rateable.

	£	s.	d.
Rates	143	11	4
Water rate	19	18	0
Taxes	62	14	2
	£226	3	6

WHITEHALL SCHEME.

Valuation ..... { £1,500 gross / £1,250 rateable } Banqueting House.
Valuation ..... { £1,460 gross / £1,217 rateable } New Building.

	£	s.	d.
Rates, Banqueting House	296	17	6
" New Building	289	0	9
Water rate, in proportion	84	1	2
Taxes, in proportion	265	3	4
	£935	2	9

JERMYN STREET SCHEME.

Valuation ..... { £2,700 gross. £2,250 rateable.

	£	s.	d.
Rates	450	0	0
Water rate	39	15	0
Taxes, in proportion	241	17	6
	£731	12	6

B. ESTIMATE OF ANNUAL EXPENDITURE.

WHITEHALL SCHEME.

Income.		
Average Income of the Institution for the last 8 years	£5,151	
Less dividends on Capital Expended in New Building	600	£4,551
Balance, estimated Yearly Expenditure in excess of present Income		792
		£5,343

Expenditure.			
Ground rent			£580
Rates and taxes			935
Lighting (say)			100
Maintenance (say)			150
Insurance (say)			29
Average expenditure of the Institution for the last 8 years		£4,133	
Less Expenses, old Building, viz.:—			
Rent	£200		
Rates and taxes	226		
Lighting	41		
Maintenance	100		
Insurance	17		
		584	3,549
			£5,343

C. ESTIMATE OF ANNUAL EXPENDITURE.

JERMYN STREET SCHEME.

Income.		*Expenditure.*			
Average Income of the Institution for the last 8 years ..	£5,151	Rent			£870
Balance, estimated Yearly Expenditure in excess of present Income	268	Rates and taxes			731
		Lighting (say)			100
		Maintenance			126
		Insurance (say)			43
		Average Expenditure of the Institution for the last 8 years		£4,133	
		Less Expenses, Old Buildings, viz.:—			
		Rent	£200		
		Rates and taxes	226		
		Lighting	41		
		Maintenance	100		
		Insurance	17		
				584	
					3,549
	£5,419				£5,419

D. ESTIMATES FOR REMOVING.

The Committee applied to Mr. Taylor, Pimlico, and to Mr. Crow, who has been employed for years by the Institution, to supply estimates as to the probable cost of moving the contents of the Institution to the Banqueting House and to Jermyn Street, and received the undermentioned:—

MR. TAYLOR'S ESTIMATE.

About 40 van loads, at £3 per load	£120
Taking models to pieces and putting them together again, about	90
Removing models, about 8 van loads at £3 each.....	24
	£234

The same charge for moving to Jermyn Street.

MR. CROW'S ESTIMATE.

70 loads, at 17*s.* 6*d.* per load	£61 5
Moving models to Banqueting House, about.....	100 0
	£161 5

The extra charge for moving to Jermyn Street would be fully covered by £50.

N.B.—In addition to the above charges for removal there will be considerable expense, which it would be at present impossible to estimate, in arranging the articles in the Museum and in the repairs of cases and furniture; this cost would be about the same in either scheme.

E. ESTIMATE FOR NEW BUILDING,

SUPPLIED BY MESSRS. WEBB & BELL.

New Building, Portland stone front, facing Whitehall.....	£18,500
Lining walls of Reading Room with plain oak shelving	600
Connecting Banqueting House to New Building, opening out ground floor windows at present blocked up, putting suitable plain oak bookcases in gallery	700
Installation of Electric Light (500 lights)	1,000
	£20,800
Architects' Commission at 5 per cent.	1,040
	£21,840

F. INVESTED FUNDS OF THE INSTITUTION.

AVAILABLE FOR BUILDING PURPOSES.

	Stock. £	*s.*	*d.*	Present price.	Market value. £	*s.*	*d.*
Consols, 2¾ per cent....	16,655	1	11	97	16,155	8	11
India, 3½ per cent.	2,028	17	8	107¾	2,186	2	4
India, 3 per cent.....	2,019	5	7	97½	1,968	16	4
Nottingham Corporation, 3 per cent.....	1,239	3	5	97	1,201	19	11
	£21,942	8	7		£21,512	7	6

G. SCHEDULE OF ACCOMMODATION.

Present Building and Whitehall Scheme.

Schedule of Accommodation provided in the present Building in Whitehall Yard and in the Banqueting House and proposed new Building on the Site of Dover House Stables adjoining.

	Present Building.		Whitehall Scheme.			
			Banqueting House.		New building on Stable Site.	
	Floor space in feet superficial.	Wall space in feet superficial.	Floor space in feet superficial.	Wall space in feet superficial.	Floor space in feet superficial.	Wall space in feet superficial.
Museum	11,277	14,979	14,721 This includes 5,000 feet of poor accommodation in basement, 1,570 in galleries, and a possible 2,000 in annexe at north end	11,800 Of which 5,000 is above the gallery level	—	—
Library	2,612 Including reading room, 432	2,690 Including reading room, 540	—	—	2,610 Including writing and smoking rooms, 860	3,310 Add 1,530 if back wall of theatre is used for books; add 2,560 if book store is constructed on top floor.
Theatre	1,180	—	—	—	2,000	—
Galleries	550	—	—	—	1,512	—
Official	2,276	—	—	—	3,041	—
			14,721 9,163	11,800 7,400	9,163 —	7,400 —
Totals	17,895	17,669	23,884	19,200	—	—

ASTON WEBB & E. INGRESS BELL, *Architects.*

JERMYN STREET SCHEME.

Museum	14,337	feet superficial.
Library and Office Room	5,416	„
Theatre	2,397	„
	22,150	

Approved by Council, 20th June, 1892.

H.R.H. THE DUKE OF CAMBRIDGE: I must in the first place apologize to this meeting for having been the cause of the change of hour from 3 to 12. I only hope that the change has not been very inconvenient to most of those whom I see around me, but it was a matter of duty which was not known to me when the meeting was arranged for 3 o'clock; and I am sure you will agree in thinking that I have done a right thing in asking you to come early in order that I might be able to preside on this important occasion (cheers). Gentlemen, we have a very delicate task to perform to-day; we have to look to the interests of an Institution which I think is of the greatest possible advantage in more ways than one. First of all the march of intellect is increasing in every walk of life, and it would be a melancholy thing if, at such a moment, this Institution, which I believe to be of great value to the two Services, should be lost to the country for the want of funds (cheers). In the next place, I think it is of great advantage that the two great elements of power in the State, the Naval and Military, should be brought together, whenever it is possible, to interchange the thought, feeling, and sentiment which, after all, constitute the mainspring of the defensive power of this country. I consider that the discussions which take place in this Institution, and the possibility of the public interchange of thought which this Institution affords, is of the greatest advantage both to the Navy and to the Army (cheers). Therefore, I cannot doubt that everyone here will wish with me that we should endeavour, to the fullest of our ability, to continue the value and advantage of this Institution (cheers). But the question to-day is really one absolutely of finance. The whole subject is one of great difficulty and delicacy. I own, when first it was brought to my notice, I was strongly under the impression that the Jermyn Street was the best site we could have under the circumstances. I admit that the site here is very preferable, but looking at the Jermyn Street site as an existing institution where we should not have had to put our capital into the ground, so to speak, we should have done better financially than probably we shall be able to do under the present circumstances. But the moment I was told that the Jermyn Street site was, after all, a doubtful one, and that we might not get it at all, and then we should certainly have lost this, I confess I absolutely changed my opinion, and now I am entirely in favour of following the recommendations of the Council (cheers). The details have not been read to you, and perhaps I ought not to be the first to go into them, because probably my friends on both the right and the left know a great deal more about them than I do; but, at the same time, it is very clear that our small capital, which at present is very small, will have to be sunk for building purposes. That is a very grave and serious matter, and all the more so when, as a result, you will find that there will be an absolute deficit of nearly 800*l.* a year. The only way to meet that naturally would be a very much larger amount of subscriptions, and I do agree with the view adopted by the Council; and the Council certainly, if I may be permitted to say so—and I think you will agree with me—have written a most excellent report, which has made clear to everybody how the condition of things at present stands, for which we ought to be very much obliged to the Chairman and members. I think they have clearly made out that we may expect a very much larger amount of subscriptions, both from the Naval and Military Services, than we at present have had. I cannot suppose it doubtful that the very fact of having now this large and fine hall granted to us, with the accommodation which is

intended to be added to it, will attract for us a great deal more notice and attention; but, even from a feeling of duty to their own cloth, naval and military, I do hope sincerely that a very large number of both Naval and Military Officers who, up to the present time, have not subscribed, will subscribe in order to keep so valuable and useful an Institution to both Services in that condition in which we wish to see it. These are the only remarks which I consider it right to make. I hope you will understand that I do not venture to offer more than my own opinion, but I have a strong opinion; I have given my reason for that opinion, and I hope that those who follow me will go into those necessary details with which I feel I am personally hardly able to deal. I thank you for having listened to me, and will now call upon the Chairman of the Council to move the first resolution (cheers).

Admiral Sir GEORGE WILLES, G.C.B. (Chairman of the Council): Your Royal Highness has said so much, and so much to the purpose, that really there is very little to be said by me as Chairman of the Council. Besides that, gentlemen, you have in your hands the excellent report of the Special Committee. For months, for years, I may say, there has been constant discussion as to what should be done about the future of this Institution. A few months ago the Council were told confidentially that we probably might have the Jermyn Street Museum, but it was to be kept secret. We were not allowed to tell the Annual General Meeting in March anything about it; whilst outside it was an open secret. At last the Chancellor of the Exchequer was good enough to remove the restriction; then we discussed the matter, and after anxious consultation, and having found from proper authority that we could not get the Jermyn Street site under five years and perhaps not at all, the Council came to the unanimous decision that it would be better to face this very grave question and take the Whitehall site. For my part, I believe it is a right decision on the whole. If we could have gone into Jermyn Street immediately, well and good. Of course, the question of finance is a serious one, but I, for one, do not fear the result in the least. My worthy friend, the Chairman of the Naval Exhibition, whom I see present, will well remember that it was proposed to the Executive Committee to spend 8,000*l.* on the "Victory" and the lake. They were staggered, but Sir George Chubb, who had had a great deal to do with exhibitions, and was our Chairman of the Finance Committee, said, "Gentlemen, the more money you spend, the more you will bring in. Make the place attractive and the people will come." What was the result? A surplus of 47,000*l.* Well, I say, in the present case there is no doubt ours will be a most attractive site, and it will draw money. The gallant Field-Marshal, Sir L. Simmons, is very sanguine that we shall derive funds by entrance money to the Museum, but what is it we really want? A thousand extra subscribers, or an increased subscription on the part of the present members (cheers), and, perhaps, from those about to join. I am certain everybody present will, if we carry the point to-day, immediately increase his subscription. For my own part I shall double mine at once. The ways and means are really in the hands of the Council. By the Charter they have the management of the funds of the Institution. The concluding words of the resolution that I shall have the honour to move are "and that the funds of the Institution be made available for that purpose." That is so. The General Meeting is to give us directions, but the Council are responsible for the management, and I say on the part of the Council, certainly of a very large majority, we do not fear the result in the least. In anticipation of your decision to-day in favour of the Council's scheme, we have already called a Council meeting for next Wednesday to take immediate action. It is to be remembered that the building will take two years to complete, in other words, we shall not sink all our capital under two years. That gives us ample time to raise funds; and I really think it would be a great discredit to the two Services if we cannot in the meantime increase our members by a thousand. In the last paragraph of this very able Report of the Committee, of which General Erskine was the Chairman, they point out what is almost incredible. I read, "When it is borne in mind what a large number of names there are on the active and retired lists of the Navy and Army, including the Auxiliary Forces (about 32,000 in all), it must be admitted as strange that not more than some 4,000 Officers have considered it their duty or privilege to be members of an Institution from which both Services have derived the greatest

benefit." I distinctly promise, on the part of the Council, if you will approve of our proposal to-day, that the administration shall be a vigorous one. Cobwebs there are plenty, and they must be swept away. As a general rule, new measures require new men, and I repeat that if you will only confide in us, we will carry out in an energetic way the proposal now laid before you, and which looks at present rather a serious one. The resolution I have to move is, "That this meeting do adopt the Whitehall scheme as recommended by the Council, and that the funds of the Institution be made available for that purpose."

General Sir F. C. A. STEPHENSON, G.C.B. (Vice-Chairman of the Council): Your Royal Highness, my lords, and gentlemen, I have great pleasure in rising to second the proposal of the Chairman, and, in doing so, I venture to say it seems to me that we have really practically no option in the matter. Members of this Institution recollect very well the difficulty we have been labouring under in getting a suitable site to replace this one. We have gone constantly to different Governments, Chancellors of the Exchequer in particular, but without any favourable result up to the present. But, gentlemen, there is one point that I wish to call attention to, and that is this. Who was it that in our need was the first to come to our help? It was Her Majesty the Queen. That is one reason why I think, practically, we have no option in the matter but to accept this site. There were difficulties in the way, inasmuch, as you all know, there was not sufficient accommodation. Consequently frequent appeals have been made to the Government so give us additional assistance. The Government have acceded at last, so that at the end of twenty or thirty years we have got that which we have been striving for strenuously during the whole of that time. Surely we should be stultifying ourselves if we did not take advantage of the present state of things and accept the offer which Her Majesty and Her Majesty's Government have so liberally made to us! There is, of course, one point to which one cannot shut our eyes, viz., the increase of expenditure that will fall upon us; but in carrying out the remarks of His Royal Highness and of the Chairman as to the way in which that is to be met, I venture to think that we should adopt the principle of "nothing venture, nothing have." I do not think the "venture" will be very serious, and I am sanguine enough to believe that the results will be very satisfactory. On these grounds I venture to second the resolution, which, I hope, will be adopted by this meeting.

General Sir REDVERS BULLER, V.C., K.C.B.: I shall be sorry, your Royal Highness, if anything I say may at all prevent anybody from voting for the removal of this Institution to the Banqueting Hall, and the site which is offered to us; at the same time I think that we should do so with our eyes open. I cannot myself accept the figures that have been given to us as quite accurate, and I believe the loss of income will be nearer 2,000*l.* a year than 1,000*l.* I do not think that it would be fair on the meeting to let them vote on such a subject without a full appreciation of what are, by some, at any rate, believed to be the true facts of the case, and with your permission I will read to the meeting a letter I received this morning from a gentleman whose name I will give. He says: "Owing to pressure of business, I have only to-day looked through the Report of the Special Committee appointed to consider the removal of the Institution to the new premises. I observe that the Committee estimate that if the Whitehall scheme be adopted there will be an annual deficit of 792*l.* I fear, however, that this sum will be far below the actual deficit, and I base my opinion upon the following grounds:—(1.) The electric lighting. An installation is proposed for 500 lights, the candle power of which is not stated. It is, of course, impossible for me to make any exact calculation of the annual cost of this installation without having complete figures as to the hours during which the light will be burned. The sum put down by the Committee is 1,000*l.* Even if the lights are only 8-candle power, which is most unlikely, I have no hesitation in saying the annual cost will be several times as great as that estimated. You are, of course, aware that I have exceptional experience on this subject" (he is chairman of the St. James's Electric Company). "(2.) The maintenance of building. The annual expenditure under this head is 150*l.* It seems to be based on a present expenditure of 100*l.* in respect to the existing building. Let me first of all point out the existing building can scarcely be said to be maintained at all, so that you can form no basis of calculation. It is

proposed to erect structures at a cost of 18,500*l.*, in addition to the Banqueting Hall. Such a range of buildings will require a much larger sum than 150*l.* a year to maintain. These are two heads only of those under which I believe expenditures to have been under-estimated, but there are several others for which an insufficient allowance appears to have been made, and I believe I am within the mark when I say that the annual deficit is likely to be a sum at least double that estimated by the Council. I am, &c., EUSTACE BALFOUR, M.R.I.A., and Major London Scottish Rifle Volunteers." I was asked to read that letter, and I did not think I was justified in refusing. And I may add to his statement another possible extra expense. I know a bank on the opposite side of the way had an enormous expense with their foundations, owing to the quantity of water there was, and I see no estimate for the allowance of any chance of extra expenditure in the foundation of these new buildings. I do not wish at all to appear as opposing this scheme, for I am in favour of it, but I think it right all should know that there are these matters to be considered. It is far better for us to face our difficulties fairly at first, and to take measures to obtain sufficient funds, than to find ourselves in want of them when half way through the work.

General ERSKINE: Your Royal Highness and gentlemen, with regard to what has fallen from Sir Redvers Buller, and what his informant and critic of our financial statement has said, I beg leave to state that we went into the matter very thoroughly. We got all the information we could with regard to the items which have been questioned, and I think that the figures given are pretty nearly accurate, but of course it is impossible at this present time to foresee all that may happen hereafter. A question has been raised about the foundation. That is a very serious matter, but I beg leave to state that, after consultation with our architects, we have not taken that matter into account. There is every ground for hoping that the foundation of the new building will be good and substantial, and will not give rise to any trouble. Of course, if it does, we shall have to meet a considerable extra expenditure, but nobody can foresee what it may be. We know that Messrs. Cox and Co., when they raised their new building, had a great deal of trouble with their foundation, and consequent expense. Whether that will be our lot or not it is impossible for us to say. I think you may, however, rely upon the outline of our estimate of expenditure as being nearly correct. We have taken a great deal of trouble about it. We have consulted different people who were likely to give us sound information, and I do not think it will be exceeded very greatly.

Colonel YOUNG: With the permission of your Royal Highness, I should like to follow with some remarks on the line taken by Sir Redvers Buller, though from a different standpoint. At the outset I desire to state that I believe the Council are to be congratulated on having adopted the Whitehall scheme, and I also believe that with courage and prudence the object to be desired can be attained. I think, however, that the estimate on which the adoption of the Whitehall scheme is based, Estimate B, shows figures which present somewhat of a difficulty in accepting that as an adequate estimate of the deficit to be anticipated. I have examined that Statement B by the estimates of receipts and expenditure which were brought forward at the last Annual Meeting, and though I think and hope it possible that I may be quite in error in my deductions, because we know that figures can be made up so as to explain away anything, I am afraid that instead of the deficit being about 800*l.* we shall be landed in a deficit of about 1,900*l.* General Erskine may, and I hope will, be able perhaps to set the meeting right on the point, and the point can by reference to certain figures be narrowed in this way. I hold in my hands the estimates for the year 1892, which show estimated receipts of 4,715*l.* Now we are going to sink the whole of our capital, 21,000*l.*, which, in the estimates for the current year, was to produce dividends amounting to 620*l.* That brings down the estimated income to 4,095*l.* Then when we turn to the other side of the account—the estimated expenditure—we find it is 4,715*l.* From that I deduct the expenses which will be saved by the transfer to the Whitehall scheme, which are set out in Statement B, 584*l.* That brings it to 4,131*l.* Then you must add the amount of rent, rates, taxes, lighting, and maintenance which appear on the same side of the account in Estimate B as part of the probable expenditure, which is 1,794*l.*; that brings the total up to 5,925*l.* The net estimated receipts I have shown were 4,095*l.*,

so that there would apparently be a deficit of 1,830*l.*, instead of 792*l.* as in Estimate B. But I will go further and compare Estimate B on the basis of the actual expenditure last year, 5,234*l.* If you will deduct from that the amounts transferred to capital account, also cash in hand, namely, 943*l.*, and the amount of rates and taxes on present building, as per Estimate B, 584*l.*, that will make 1,527*l.* together, leaving a sum of 3,707*l.*; then add the new charges for Whitehall scheme as in Estimate B, namely, 1,794*l.*, and you bring the total expenditure to 5,501*l.* If you deduct from this the net total income available, as I have shown, namely, 4,095*l.*, the deficit will apparently be at least 1,406*l.* I therefore think, while, as your Royal Highness said, the whole question is one of finance, that these matters are deserving of some consideration, because it is right that in dealing with a matter of this kind we should go upon definite and clearly ascertained grounds as to probable receipts and expenditure (cheers).

General ERSKINE: With regard to what has fallen from Colonel Young, as far as I could follow him, it appeared to me that he reckons the saving which we have made in our expenditure during the last five years as loss of income.

Colonel YOUNG: I took the actual estimate given in your Annual Report. I did not go upon anything else.

General ERSKINE: We have taken the average of eight years for income, and also for expenditure.

Colonel YOUNG: I think that is likely to be fallacious.

General ERSKINE: I do not see how we could have done it in a fairer way.

Colonel YOUNG: My point is simply this. We know what we have in hand. I submit that you cannot, in estimating receipts and expenditure, go beyond the facts as they are at present, and which appear in the accounts of last year, and I have therefore limited myself entirely to the facts as given by the Council in their last Report.

Field-Marshal Sir LINTORN SIMMONS, G.C.B., &c.: Your Royal Highness, my lords, and gentlemen, I was one of the Committee that drew up this Report, and, although I did not go into every figure myself, I believe that, generally speaking, the figures are correct. At any rate, they are comparative, as to the expense we shall have to incur if we adopt the Whitehall site, and that which we should have to incur if we adopt the Jermyn Street scheme. You will observe the same amounts are put down for lighting and various other items in the one as in the other; and the probability is that any increase that might be incurred on account of any of these items in the one will be equally incurred in the other. But the practical point is really this, that there is a difference of 500*l.* a year in the expenses you have to meet in the Whitehall scheme, as compared with the Jermyn Street scheme. There is a point, however, on which I venture to differ from your Royal Highness, as to the question before us being merely one of finance. I think it is a question of the existence of this Institution. This building is rotten. Looking at those great cracks in the wall before you, it cannot be expected to stand for any length of time; we are, moreover, under notice to quit, and the Government may turn us out at three months' notice. Under these circumstances we cannot do anything to improve the Institution, or to increase its utility. We have been called upon and pressed on all sides at the General Meetings, and urgent demands have been made upon the Council, to increase and improve the utility of this Institution, but the Council are powerless to do anything in this building in this direction; so that, I believe, if we continue in this building for five years the Institution will come to an end. There is no prospect whatever, if we adopt the Jermyn Street site, of our getting it within five years from the present time; for I am told that a building must be erected at South Kensington to house the Museum from Jermyn Street, and when that has been done we may get into it and fit it up; but in the meantime, during the five years, the site adjoining the Banqueting Hall will perhaps be taken up in some other way, and we shall lose one of the finest sites possible (cheers). There is another point which is worthy of consideration. A scheme has been put forward by Sir George Chubb which I venture to allude to as one which, if carried out, will be of the greatest possible benefit to the two Services. It was suggested, I believe, a great many years ago; but at any rate Sir George Chubb has brought it forward again; he has proposed one large building, of which the Banqueting Hall

should be on the one flank, the ground we propose to build upon should be in the centre, and a building on the site of Gwydyr House should be on the other flank, thus making one magnificent United Service Institution, which would be of the greatest possible benefit to the two Services, and of which the Services and the country might be justly proud (cheers). Well, I look upon it that anything we do here may be utilized in that direction, and that what we propose to do, if the members choose to entrust us with the power, would really form a part and parcel of that great scheme whenever it is realized. I think this is a consideration of which we should not lose sight. There is another matter with regard to the stables of Dover House. Discussion has been going on for over a year and a half, and efforts have been made to get possession of the site; we had hoped that the Government would have given it to us, but we must remember that we are proposing to pay the market price that the Government would demand from any other party who might occupy that ground; they let it to us for a ground rent of 580*l.*, and we shall have to meet that rent. It is a heavy ground rent, but I hope that some day or other, if the Government see the great utility of the Institution, and the advantages it offers to the Services, they may possibly reduce the rent, or give us something which will enable us to meet it. I hope and believe that, eventually, the utility of the Institution will force upon the Government the necessity of giving us more assistance; but, even without that assistance, I am most sanguine that we shall make up the full amount we shall require, and that the Institution need not be alarmed as to the difficulty of this work and as to its final success.

Colonel MALCOLM GREEN, C.B.: I should like to ask who will be responsible for the 792*l.* put forward by the Committee as likely to be in excess of our receipts.

Sir GEORGE WILLES: Perhaps Colonel Baylis will answer that question.

Colonel BAYLIS, Q.C.: I have been asked a question with reference to the liability of the Institution as to the probable deficit. Allow me in the first instance to say that I do not expect a deficit. There are two ways of meeting excessive expenditure, one by reducing our expenditure, the other by increasing our income. I believe that we shall reduce our expenses materially with regard to rating. If you look at the estimated rating of this Institution, in the Whitehall Scheme (A) the rates and taxes amount to 935*l.* 2*s.* 3*d.*, the annual deficit being 792*l.*, yet you will find that the Geological Museum is exempted from rating, as well as other like institutions for public purposes, and there are many kindred institutions to our own which pay no rates, the statute 6th and 7th Victoria, chapter 36, exempting institutions for the purposes of literature, science, or the fine arts exclusively, from local rates.[1] Why is this noble and useful Institution "for the encouragement and extension of naval and military science and literature" not to be treated on the same footing? I believe first of all, as I said, that we shall reduce our expenditure in the matter of rating. Allow me another word with regard to the foundations. The foundations were considered (with great deference to General Erskine), because I started that point myself at the Special Committee. I meet it in this way. There is a large massive building still there—the Banqueting Hall; there are the stables where we propose to build, adjoining another large building of the Ecclesiastical Commissioners; all must have suitable foundations. Are we then in any fear at all that our new building will not be supported by the same or similar "sure foundations"? (Cheers.) Add to these that we have now the Thames Embankment, which will keep out the percolation of water, and I think there is nothing to fear on that head. With regard to our reducing our expenditure and obtaining increased subscriptions, I, speaking as a Volunteer Officer, may say that I am proud to be a member of the Institution. It is one of the greatest privileges of my life to be a member, and I say that the Volunteer Forces have a reserve of both men and money on which you may depend. If they do not

[1] Before the granting of the Royal Charter of incorporation "The United Service Institution" was held not to be exempted from rating, as their deed did not relate exclusively to literature and science. Our charter uses the words "Naval and Military Science and Literature," Reg. in St. Martin's-in-the-Fields, 21 Lg. P. M. C. 53, 162 B. 480. However, if unsuccessful in the courts of law we may have recourse to the Legislature to obtain exemption.—T. H. B.

come forward to assist in every way, we shall be ashamed of them. Excuse me for having said by way of preface, so much. Now, with regard to the point on which I was asked to express my opinion as to legal liability, let me say first that we are indebted to the Queen not only for the Banqueting Hall, but also that it was in the 22nd year of her reign, Her Majesty gave us our charter of incorporation by her letters patent,[1] and as a corporate body we are under no individual liability. It can only extend to the funds of the Institution. Of course if any member chooses to pledge his personal responsibility, he can do so. I am sure that we of the Volunteer Forces will assist in this matter. We will come forward with debentures, we will increase our subscriptions, we will do everything in our power. I hope the two great Services will do this likewise, but at any rate I am sure that the Reserve Forces will come forward and do everything to support this noble and useful Institution (cheers).

Commander SULIVAN, R.N.: I think it is well that you should hear the opinions of one of the poorer and less important members of the Institution. I only joined this Institution a very short time ago, and the reason why I did not join it earlier was that I knew absolutely nothing about it, during the whole of my time in the Service, except that it was generally considered that there were an empty theatre, a musty old museum, and a few ancient books, and it was not until I came here, brought accidentally in connection with the Exhibition, that I knew anything as to what the Institution was. When I saw what it was and knew something about it, I joined it at once, and every day that I have belonged to it I have found that it has been more and more valuable to me. This Institution, I believe, is not going on very well, because of the uncertainty as to what we are going to do. As I said before, I am a poor man, but I should have no objection whatever to give a small donation to increase the funds, and I think that everyone who knows anything as to the value of the Institution will do the same. There are other members who might give thousands perhaps where I give pounds, and if other people will do as much as I am willing to do in comparison, I do not think we shall have any difficulty. But even if we only increase our subscriptions by one-half—I am not a good hand at figures and I do not know much about calculations—but it seems to me that half of 4,000*l.* is something like 2,000*l.* I advocate most strongly going to Whitehall, and I should suggest to all the members present that it very much depends upon them whether people know as little about the Institution as they do at present. During the two years that I have belonged to it, living in a small country place, I have obtained at least two promises to become subscribers by telling them something about it, and I think other people might do the same (cheers).

Lieutenant-General LOWRY, C.B.: I want to make just this remark—I have every confidence that, when the urgency for and importance of the proposed course of action is put thoroughly and explicitly before the Navy and Army, the two Services will rise to the occasion, and that we shall have a greatly increased number of young Officers joining the Institution. But I think it a matter open to gravest question whether, supported, as I earnestly trust this great work will be for the future, far more numerously by Officers of the Army and Navy, it will be possible or well to attempt to double the subscription! Would it not be far better to leave the subscription as it is, and to rely upon Officers of all ranks, when the great future of the Institution—as it is bound to become if we adopt the Council's recommendation to-day, is made plain to them—coming forward in much increased numbers to swell the list of its members? I fear any proposition to double the annual subscription, other than entirely voluntarily, would deter not a few young Officers from joining it at all (cheers). I look upon the Institution as of the greatest possible advantage to the higher education of Officers of all ranks of the Services; and let me include most heartily and most earnestly the grand Auxiliary Forces to which Colonel Baylis has just so well referred. We must do all in our power to get those forces to co-operate with us largely in this work. If they—"*tria*

[1] May a hope be expressed that Her Majesty will have health and strength, and be graciously pleased to open the Banqueting Hall and new buildings, the benefit of which can hardly be over-estimated?—T. H. B.

juncta in uno"—so join with us in increasing numbers, this Royal United Service Institution will have taken a new departure to-day which must tell for all time to the great advantage of the United Services of the country.

Admiral Sir VESEY HAMILTON, K.C.B.: The Field Marshal pointed to the crack in the wall. I hope I am not taking upon myself too much in saying that everybody here present is heartily ashamed of the building we are in.

Sir GEORGE WILLES: With your Royal Highness's permission I may state that I have a letter from Colonel Sir George Walker, A.D.C., who has immediately increased his annual subscription to 2*l*. I think that is a very good example.

The resolution, having been put from the Chair, was unanimously adopted.

General LORD CHELMSFORD, G.C.B.: Your Royal Highness and gentlemen, after the unanimous decision we have come to, I feel sure the resolution which I have now to propose will be received by you in the spirit in which I anticipate it ought to be. It is:—"As the scheme now adopted will result in an increased yearly expenditure of 792*l*., this meeting pledges itself to do their best collectively and individually to obtain the necessary increase of funds which will be required to place the finances of the Institution in a condition to meet such increased expenditure." You have heard, in the Report which has been drawn up by the Special Committee, that there are, at the present moment, only 4,000 out of 32,000 who belong to the Services, on the retired and active lists, that are members of this Institution. That only represents 12½ per cent. The additional thousand members which we require will only make the proportion under 16 per cent.; or if the increased expenditure is as much as has been foreshadowed by Sir Redvers Buller and Colonel Young and others, the addition of 2,000 members will only bring the proportion to under 19 per cent., an addition of 6½ per cent. only to our present numbers. I feel sure that all those here present will go away from this meeting thoroughly determined to proclaim the benefits of the Institution to the Services. Everything depends upon individual efforts, and I am sure the appeal which the Council has made to you this day, and which you have so loyally responded to, will result in a large increase, a proper increase, to our numbers, and that we shall feel, in a very short time, that we shall be absolutely prepared to meet the increased expenditure with an income which will be fully adequate to our requirements. I must congratulate the meeting upon the unanimity which it has shown. It was perfectly right that the difference of opinion which was expressed by Sir Redvers Buller and Colonel Young regarding our future liabilities should have been brought to your notice, but, whether it is an increased expenditure of 1,000*l*. or of 2,000*l*., I feel sure the Services will rise to the occasion, and that we shall have no anxiety whatever in the matter of meeting it.

Admiral BOYS: Your Royal Highness, it gives me much pleasure to be called upon to second this resolution. I think everything has been said that can be said. I will only refer once more to the dilapidated condition of this building. The Chairman of the Council has promised you energy as far as the Council are concerned in the move that is now sanctioned. Immediate action is an absolute necessity, for if we stop here much longer the place will tumble down and we shall be driven into the street. As a proof of the value of the Institution to the Government, when I was in the Chair at a General Meeting two years ago, I received a note from the then Director of Naval Intelligence at the Admiralty, who stated that he had been wanting some special information, and it was not at the Admiralty. The only place he could and did find it was in the records of the Royal United Service Institution. I beg to second the resolution.

The resolution was then put from the Chair and carried unanimously.

Field-Marshal Sir LINTORN SIMMONS: Your Royal Highness, my lords, and gentlemen, there is one great feature with regard to this Institution which cannot be overlooked to-day. We owe a great deal of our success to the invaluable support which it receives from his Royal Highness the Commander-in-Chief (cheers). His Royal Highness has frequently presided over our General Meetings, and he takes the greatest possible interest in the Institution, knowing how much it does for the benefit of both Services. One great advantage of having his Royal Highness in the chair is this, that both Services equally look up to him (cheers). Therefore he is more likely than any other man in Her Majesty's Service to secure that unanimity

which ought to subsist at all times, and always has subsisted between the two sister Services (cheers), whether on active service abroad or on peace service at home. I venture to move, therefore, that the thanks of this meeting be given to His Royal Highness for presiding on this occasion, the proceedings of which will have more to do with the success of the Institution than those of any meeting which has been held since its first formation (cheers).

Admiral Sir HOUSTON STEWART, G.C.B.: I am very proud that the honour of seconding this motion has been committed to me. It must be at all times a great gratification to a Naval Officer to have the opportunity, even in the smallest degree, of testifying to what I believe His Royal Highness well knows, the great respect and esteem, and, Sirs, as truth cannot be presumptive, I may also say the affection which we entertain towards him. His Royal Highness has proved that no one is more alive to its importance, or has a deeper interest in the Royal Navy than he has, and he has taken every practicable opportunity of advocating and helping the improvement of our Service, for which we are very grateful.

The resolution was carried by acclamation.

H.R.H. THE DUKE OF CAMBRIDGE: Gentlemen, I feel more than flattered by the kind manner in which this resolution has been brought to your notice, and the very affectionate manner in which it has been seconded. I take this opportunity of again assuring this large assembly of the United Services that I have but one feeling, namely, the interest of Her Majesty and of this country, and I believe that that feeling can be best acted upon by doing everything in my power to assure both Services that I do not think that because I belong to the one, I ought not also to enter into the sentiments of the other (cheers). You have done, I think, if you will allow me to say so, a very right and proper action in coming to this unanimous resolution to-day, and I hope that it will not be supposed that my words of warning to a certain extent, were intended to be a damper. The result proves that they were not, and I can only agree with every speaker that has addressed you to-day that it would be, I may say, almost a disgrace to the Services if we do not maintain, and improve, and extend this great Institution in such a manner as to do credit to the two Services which, I believe, greatly benefit by its existence. I thank you most cordially for the kind reception you have given me, for the manner in which you have listened to me, and for the very handsome compliment you have paid me (cheers).

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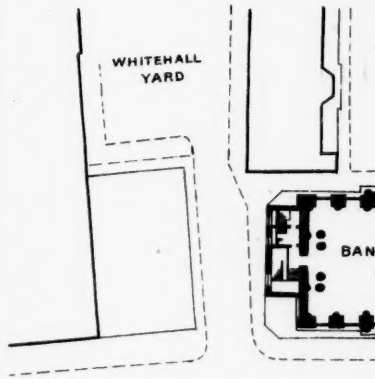

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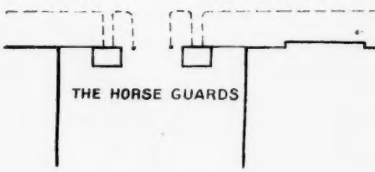


SCALE OF

ENTRANCE HALL, GRAND STAIRCASE

LECTURE HALL
LOWER MUSEUM

GALLERY OF LECTURE HALL.
COUNCIL ROOM
SECRETARY
MUSEUM

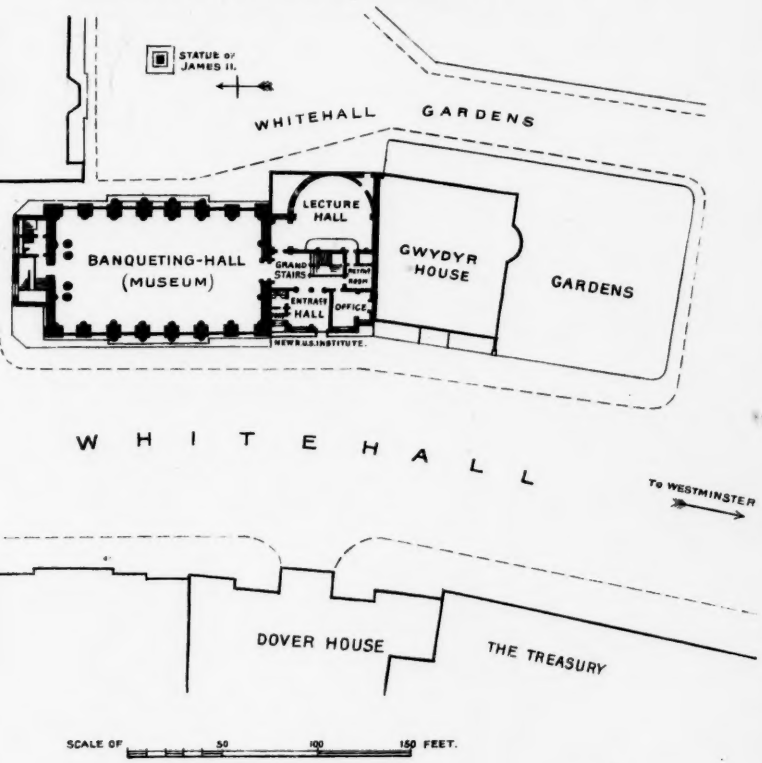
WRITING ROOM
REFERENCE LIBRARY AND READING ROO
ASSISTANT SECRETARY

WRITING AND TOPOGRAPHICAL ROOM
GALLERY ROUND REFERENCE LIBRARY.
GALLERY TO MUSEUM

NEWSPAPER AND PERIODICAL ROOM
QUARTERS FOR CARETAKER.

GROUND PLAN SHOWING
E NEW BUILDING OF THE ROYAL UNITED SERVICE INSTITUTION, AND SCHEDULE OF THE ACCOMMODATION.

(ASHTON WEBB & E. INGRESS BELL, ARCHITECTS.)



SCHEDULE.

ENTRANCE FLOOR.

ND STAIRCASE - - - Members' Lavatory, Hats and Coats, Office for Clerks, Porter, Service Stairs and Lifts to all Floors.
- - - - - - - - 48′ 0″ by 40′ 0″ (average).
- - - - - - - - 166′ 0″ by 52′ 0″ (under Banqueting Hall).

PRINCIPAL FLOOR.

HALL.
- - - - - - - - 29′ 0″ by 20′ 0″.
- - - - - - - - 13′ 0″ by 11′ 6″.
- - - - - - - - 110′ 0″ by 55′ 0″ (Banqueting Hall).

FIRST FLOOR.

- - - - - - - - 42′ 0″ by 20′ 0″, with Lavatory, &c., attached
ND READING ROOM - - - 42′ 0″ by 32′ 0″ (average).
- - - - - - - - 16′ 0″ by 11′ 9″, adjoining Library.

SECOND FLOOR.

PHICAL ROOM - - - - 42′ 0″ by 20′ 0″, with Retiring Room.
RENCE LIBRARY.
- - - - - - - - (Banqueting Hall).

TOP FLOOR.

DICAL ROOM - - - - 43′ 0″ by 20′ 0″ (average).
KER.

HARRISON & SONS, LITH. ST MARTINS LANE, W.C.

FOREIGN SECTION.

THIS portion of the Number, hitherto the Occasional Notes, has now become the Foreign Section, and is reserved for articles, either original or compiled, on professional subjects connected with Foreign Naval and Military matters; also for notices of Professional Books, either Foreign or English.

The Council of the Institution wish that this section shall be developed still further, and I have undertaken to continue my Editorship during the current year, with a view of aiding them in carrying out this work. It seems to me possible to make this section, and consequently the Journal, the means of keeping our Members acquainted with all naval and military progress abroad *pari passu* with that progress; and I shall be glad to receive from members of both Services, including in the latter those of the Auxiliary Forces, suggestions, information, or offers of assistance.

It is desirable, further, that I should state that, as regards editing the Naval matter in the Section, I shall have the aid of Naval Officers, thoroughly competent to give good advice and to pronounce sound opinions.

It must, however, be borne in mind that, as the change from a quarterly to a monthly issue has been made in order to ensure the more prompt publication of the Lectures after their delivery than has hitherto been the case, the Foreign Section will, as a rule, be restricted in extent during the Lecture season in the first half of the year, and will be prominent in the second half.

It is requested that communications and books for review (the latter under cover to the Librarian) may be addressed to me at the Royal United Service Institution, Whitehall Yard, London, S.W.

LONSDALE HALE,
Colonel R.E. ret.

TORPEDO-NET DEFENCES.

(Translated from the "Rivista Marittima" for June, 1892, by THOS. J. HODDY, Chief Engineer, R.N.)

IN order to protect war vessels from attack by torpedoes, special nets of steel wire were manufactured, which, maintained at a convenient distance from the hull by means of booms of wood or iron, manipulated and largely reinforced by steel hawsers, pulleys, and purchases, completely surrounded the hull to a certain depth, and which were supposed to be capable of being kept in position both with the ships at anchor and while under way, to be got in and out with great facility, and to constitute a defensive element of great value without being a dangerous impediment.

With these nets experiments of various kinds were made, which were far from being economical; they encumbered all ships more or less, according to the type and the height of freeboard of each, and were scarcely introduced when ships of the slightest military importance barely escaped being lumbered up with them, such as transports and small vessels, where the encumbrance became most serious, and manœuvring an impossibility.

It was said that, as formerly the crews were trained in drill aloft, so now they should be trained to drill with the nets, so as to render the manœuvre easy, and be able to carry it out with great expedition under all circumstances of navigation or military service. In the technical publications various notes and criticisms appeared on the employment of these nets, but these notes nearly always appeared in an incidental manner as representing a simple personal opinion or observation, and, as far as I know, were never written comprehensively and explicitly against the invention in particular. Very inconclusive, in our opinion, were the experiments made with these nets; because carried out in peace-time, and under circumstances very different from the reality in war and in navigation in the open sea. Torpedo-net defences are now fitted to almost all ships of a definite military importance and of considerable dimensions; the employment of these nets thus becoming general, a method of providing the torpedoes with a special nipper, designed to cut through them, has been found, and the good results obtained with these nippers has succeeded in diminishing almost completely the defensive value of the nets, because it is an acknowledged fact that the ordinary nets can be cut cleanly through by the new nippers, and the torpedo pass freely through the hole thus made. In consequence of this it is thought advisable to increase the resistance of the nets, and it appears some navies provide, or will provide, their ships with nets weighing 50 per cent. more than those employed up to the present,

and presenting an efficient resistance against torpedoes furnished with the net cutters. It is to be supposed, considering the continued rivalry between the offence and defence on the sea, that nippers will certainly be found good enough to cut also the new nets, especially with the introduction into the service of torpedoes of large dimensions and heavy explosive charges; and probably the net makers will strive to invent another type of net of superior resistance, and so, *di seguito*, till practical experience shall bring in some efficient teaching for which some one will dearly have to pay.

In the many experiments made with nets, many specialities were brought out, either in the various modes of twisting and disposing the steel wire, or with tubular booms joined up in various manners; many were the modifications for each type of ship in the relative positions of the booms, in the points of attachment to the hull, in the manipulation of them, and in the rigging necessary for their management. However, as a result of these experiments, it was demonstrated more or less convincingly, according to the various theoretical opinions of the nets, and of the value of these experiments, that there was a great difficulty in defending the extremities of the ship, because of the difficulty of arranging and manœuvring the nets at these points, and this also in the most favourable case, that is, with the ship at anchor; it was, therefore, evidently impossible to obtain a practical defence from nets spread at sea with the ship in motion, even at the most moderate speed; it was proved that with the ship under way the nets came more or less to the surface, that they were carried towards the stern, and that the system experienced violent shocks, which were not all reassuring, especially in close quarters or in a slight sea; leaving out of account that the speed of the ships and the ability to make efficient use of their armaments were greatly diminished by the serious impediment and encumbrance; on some ships it happened that, under the conditions of navigation in the open sea, the booms were stripped and carried away, and brought up and down alongside the ship—and it is to be noticed that the experiments were generally carried out with new material, and not with material chafed and worn by the action of the sea water, or by frequent use at drill. Whoever has assisted at one of these experiments will surely remember the infinite inconveniences of installation, manipulation, and weight, which were remedied, as far as possible, with impossible stays, hawsers, purchases, winches, and gear, which ended in straining the decks, starting fastenings, and playing havoc generally; he will remember the never-ending carrying away of booms, bolts, and brails, and the constant expectation that, by the rupture of a head-stay, the whole system would inevitably disappear astern, just dropping nearly over and enveloping the projecting twin screws.

And all these inconveniences take place in peaceful experiments, being inherent to the system, and no account is taken in them of those inconveniences, much more serious, which it is logical to suppose would be caused in action against the enemy. One can easily imagine how much more grave would become all the inconveniences

enumerated when, in order to obtain greater resistance, heavier nets than those now commonly in use are employed. But leaving out of consideration at present the system and weight of the nets adopted, we notice that a ship of any class will be in a position to defend herself with nets in time of war, only on condition that she has not as yet taken part in any engagement with other ships. Especially after the introduction on board of numerous quick-firing guns of considerable power, it is not possible to admit that any ship can remain, even for a short time, exposed to the fire of an adversary without receiving damage to her net defences; nor is it logical to suppose that, in a defended place, opportunity could be found to place the nets in position, with all the necessary booms, hawsers, rigging, and gear; and even in the impossible case that a ship should be specially constructed, almost for this purpose alone, and she succeeded in doing it, it is certain that the supports of the booms, the points of attachment of the sheaves for inhauls, outhauls, brails, &c., and the necessary winches and fair-leads, would be damaged, just as every other part of the ship not efficiently enclosed and protected by armour would be considerably damaged; leaving out of the reckoning that even if means could be devised to protect the whole or a good part of the net system, keeping it under cover and protected by gun fire, it would truly be a disastrous operation to get it all up and in place after or during some phase of the combat, in order for the ship to protect herself from torpedo-boats, which exactly under these circumstances would be tempted to make an attack. Certain it is that the entire system of net defence which might be struck by projectiles would be the occasion of most dangerous splinters and fragments, more or less numerous; and it is certain there is no need to augment the probability of these sort of dangers on board modern ships, encumbered too much already with weak bulwarks, bulkheads, rigging, and fittings of every description.

It is therefore reasonable to admit that a ship of any sort would be able to rely on her net defence, in the single case that she has not as yet encountered the enemy. This general consideration is in my opinion important enough to constitute of itself, if not an absolute condemnation of the nets, at least a very efficient argument against them. But leaving out this and the positive fact that the actual nets in use do not stop torpedoes provided with net-cutting nippers, let us pass to the consideration of various conditions of maritime war, and more especially those in which the employment of the nets may be considered most justifiable. Evidently such cases are those in which the attack by torpedo-boats is most to be feared, and in which action by them is likely to be most opportune and efficient; generally these cases will depend on the development and character of the war on the sea, and which development and character will be imposed by the physical, hydrographical, and political conditions of the belligerent nations, and by the objects to which each must rationally subordinate the constitution and employment of its own maritime forces. In actions on the open sea between isolated ships or between squadrons net defence is not to be thought of, not even when contemporary

or subsequent attacks by torpedo-ships are to be feared; nor is it worth while that we should lose time in discussing such an evident fact, which is demonstrated by the experiments made in time of peace. When in the particular conditions of the vicinity and preponderance of maritime strength it is proper that one of the belligerent nations should commence the attack by some sudden and devastating incursion into the waters and on the coasts of the enemy, the principal elements for the success of this operation will be its suddenness and rapidity of action, and therefore the speed of the ships employed; consequently, although it is logical to suppose that attacks by torpedo-boats are to be feared, a squadron that attempted such an operation would not be able to keep the net defences down in expectation of them, for the principal advantage of speed and liberty of action would be lost, and the squadron would find itself in a very bad position if it should fall in with the ships of the enemy, an event which may be considered just as probable as an attack by torpedo-boats. The same may be said of an expedition by a single ship into an enemy's water, either for observation or any other object; and, therefore, we conclude that in actual war no Commander of a naval force or of a single ship who knew there was a chance of meeting the ships of the enemy in the zone in which he operated would risk keeping his nets down for fear of torpedo attack even if it were true that the nets could be taken in and stowed away for action in the smallest possible time, or if it were certain (which it is not actually) that they would stop the torpedoes. To protect the squadron or ship he would employ light ships, as torpedo-catchers, or even torpedo-boats. We can admit that ships would obtain information and be forewarned almost exclusively by torpedo-boats, and on such service would make large use of the nets when they had succeeded in clearing the sea of the enemy, and the war should finally assume a decidedly coasting character; but, as we have already said, such a service would be possible to such ships only as have not yet been in action, and very few would be in this condition in the final period of the war.

Passing on to examine other conditions of maritime war, let us consider the blockade and bombardment. The blockade at the present day cannot be considered as a very probable operation, nor can it be considered in the absolute sense of former times; in modern warfare it would result principally in a special cruising service carried out in various ways according to the locality, the force employed, and the object to be obtained. The naval force which maintained the blockade would probably chose a base of operations in proximity to the point to be blockaded, where it would anchor, ready to move as soon as its scouts had advised it that the enemy's ships would attempt to force the blockade. Particularly at night, the blockading force should have the torpedo-nets down in readiness to protect itself from torpedo-attack; but it is natural to suppose that the night time would be just the time the enemy would choose to force the blockade, if it were in a condition and under a necessity to attempt it, and therefore the blockading force ought to be ready

to act against and follow the enemy in the shortest possible time; if caught with nets down much valuable time would surely be lost in getting them in and stowed, so as to be no impediment in the pursuit, perhaps in a heavy sea, or in the action that might follow. Again, it is necessary that the blockading ships should be secured against a sudden attack by the ships of the enemy other than those blockaded, for if by accident it should be caught at anchor or under easy speed, with the nets down, even by a few cruisers which, especially at night, should open a brisk fire on it, the condition would not be a very joyous one; very possibly more than one ship might find herself in a bad case, and run a risk of having her screws rendered useless in the confusion of a sudden attack and the inevitable tumult which would take place in getting the nets in in a hurry and under fire; it is almost certain all the ships would cut away everything in the bustle, and cast the whole system adrift, thinking themselves lucky if it succeeded without some grave damage which would paralyze them fatally; and if the attack by the cruisers as we have described should be followed immediately, and during the confusion, by a torpedo-boat attack, the condition of the blockading force would be much worse than it would have been if it had been caught without the nets down. Besides, even if the blockading force were attacked by torpedo-boats only, and admitting that a special quality of net might be able to stop the torpedoes, we assert that the extremities of the ships cannot be efficiently protected; and, therefore, in the confusion which, in our opinion, renders an attack by torpedo-boats more certain against a number of ships than against a single ship it would not be difficult for the boats to hit some one of the ships in the undefended part, provided that they made a swift and resolute dash on her; and this can be said more or less both in the case when the blockading force is at anchor or under easy speed. It would be less easy for the torpedo-boats to operate successfully against a ship cruising alone or posted at a given point, but if they are numerous and manœuvred with ability and spirit, especially if their attack is preceded and supported by a rapid fusillade, even by the light guns of small torpedo-cruisers, we are certain that the torpedo-boats would succeed in blowing up the ship, in spite of the strongest torpedo-nets that can be invented. We repeat, however, that the torpedo-boats will have a much better game when they attack many ships together, especially if at the same time they use their electric lights and light guns. It is certain that it will not be a very happy time for those ships that have to hold a position at night on shores infested by torpedo-boats; the best defence will consist in keeping at a distance from such places as soon as they can, and, if this is impossible, to trust in a vigorous service of observation and watchfulness, making use of cruisers, torpedo-catchers, torpedo-boats, and launches, and also protecting themselves with improvised obstructions when the base at which the ships must remain will admit of it. Both in the case of a squadron and of a single ship surprised by torpedo-boats while cruising, the best course would seem to be to get under way at full speed, for we are of opinion that the speed of the

ship will be a defence preferable to that of the best possible system of nets.

As regards the case of bombardments, we would observe that this might possibly take place at the commencement of a war, as a sudden method of offence on the part of a preponderating force, and in such a case would be generally directed against unprotected towns or points weakly fortified, and with great difficulty against a position properly constituted and defended. The squadron carrying out the operation would have to do it quickly, and hold itself in readiness to meet an attack from the enemy's ships; we do not believe that it would do to keep the net defences down, because it appears natural to us that, unless under special circumstances, the bombardment would take place by day, the squadron taking the offing at night, which is certainly favourable to insidious attacks by torpedo-boats; the security of the bombarding squadron against these attacks from the point bombarded or its vicinity, should be obtained, in our opinion, by an attentive service of observation with light ships and other torpedo-boats, which should hold themselves in readiness to repulse the attacks of the enemy; and in the worst hypothesis, when the squadron has not sufficient means to repel these attacks, the ships should put to sea as soon as the attacking boats are discovered, and deal with them when in chase. The bombardment might also take place during the war, not as a sudden and preliminary operation, but as a means of hastening the surrender of a sea-port, or to weaken some given defended points of the enemy's littoral, but less probably under these conditions. In the special case of bombardment of a properly-constituted maritime position we would note that it is not possible to admit that the ships carrying it out would then be in a condition to adopt the net defence; the said operation would take place during the last phases of the war, and the ships would then certainly have been in action more or less, and would not have their net defence in a serviceable condition. But admitting that the ships could have their nets in order, we would observe that the bombardments would be carried out with the ships under way, when they cannot possibly keep the nets in the water, because, beyond the observations already made on this point, as the fort would suddenly open fire on the ships, if they kept their nets down they would be obliged to move very slowly, and any damage done to the net system might necessitate stopping to put it right, or might result in jamming up the propellers just when the ship is exposed to the dropping fire of the fort.

We will not continue further to specify other hypotheses or eventualities, because the above suffice for every case, whether in regard to the condition a bombarding squadron might find itself in when surprised by the enemy's ships with its nets down, or in regard to the means which we consider most advisable to protect the ships against an attack by torpedo-boats from the place bombarded or its vicinity.

Finally, we pass on to consider a special case which may be brought forward to show the necessity of providing ships with

torpedo-nets. Such a case would be when a ship is obliged, by damage to her machinery, which prevents her reaching a defended harbour, to anchor in an undefended, or insufficiently defended, roadstead, or on the nearest coast, in order to make good her defects as best she can; very probably she would have to fear attacks by torpedo-boats, and therefore would find her nets very useful. But in what circumstances, we would ask, could a ship of any importance find herself in the condition described and isolated in this manner? Not certainly under ordinary conditions of navigation, or very improbably, for almost all modern ships have duplicate machinery, and we cannot admit that such damage could be done, but that she could with one engine alone, at least, reach a safe port for repairs. Such extensive injuries could only occur as the result of an engagement, and then if the ship formed part of the defeated naval force, she would be certainly either captured or sent to the bottom before she could anchor in any port whatever; if she belonged to the victorious force she would certainly not be abandoned and left to her own resources in a dangerous spot, except in such strange and impossible circumstances as cannot be reasonably imagined; she would be surrounded, protected, and also moored in a secure position; if the damage be the result of an action against another single ship, she will certainly be lost. However it may be, or whatever the hypothesis, a ship which finds herself in such a condition after an action will have her net defences in a more unserviceable condition than ever. This postulated, it would seem useless to lose time in demonstrating that the torpedo-nets could not save a ship anchored in an undefended position and unable to move; evidently the enemy will do his best to destroy such a ship, and will use all the means at his disposal, and either by attacks with ships or torpedo-boats, or both combined, he will succeed in his intent, without any doubt whatever, whether the ship has nets to protect herself or not, or whether such nets are really effective or not; nor will the batteries of a partially defended harbour be able to save her from complete destruction; the only means of safety will consist in the support and protection that her companions and their torpedo-boats can afford her. We will not delay longer in imagining and discussing the cases and eventualities of war which might be invoked to show the necessity of torpedo-nets, for whatever hypotheses may be stated to this end, it will not be possible to neglect the value of the general considerations above exposed, and whatever special case may be imagined, it will be easy to show that they will decide always and surely against the nets as dangerous and inconvenient. The importance and efficacy of quick-firing artillery, especially in actions between ships, has arrived at such a point that the gun must be considered as the first and most inevitable element of damage more or less serious, and as no other part of the ship is more exposed than the nets to the first effects of artillery, therefore we conclude that, rather than serve as a problematical defence, the torpedo defence system would only serve for the production of dangerous splinters and fragments. And then a positive and irrefragable argument in our favour consists in the fact,

already cited above, that the actual nets are not able to stop the torpedoes, and it is reasonable to think that nippers will be found which will cut through nets of greater resistance than now actually in use with equal certainty.

After what we have stated in order to show the slight use of the nets, and the impossibility, almost, of obtaining an efficient protection from them, it may be asked, In what manner would you provide for the defence of ships against torpedo-boats? To us it seems that speed is one of the principal elements which would contribute to the safety of a ship attacked by torpedo-boats, and perhaps the principal element; a ship which finds herself in this position, in our opinion, should take to her heels, if she can, and the faster she is the greater chance she will have of escaping the torpedo-boat, and more hope of defeating them and being herself unhurt. Every means should also be sought to strengthen the hull, taking advantage to this end of the large displacement which is rendered necessary, especially in battle-ships and large cruisers, in order to provide an efficient protection against the numerous quick-firing guns. It should be endeavoured to localize the damage caused by a torpedo as much as possible, although this is now rendered far more difficult by the introduction into the Service of torpedoes of large diameter and very heavy explosive charges; but, above everything else, it should be remembered that the large ships must always be protected by an efficient service of observation, and escorted by cruisers and torpedo-catchers, to which numerous and good torpedo-boats should be added when the ships are obliged to act in a dangerous locality. In our opinion, the torpedo-catchers and torpedo-boats are as yet the best means of protection against the insidious attacks of their companions.

It is certain that for many warlike operations of a specially coasting character, the importance of the torpedo-boat is very great, and it is our opinion that, except in very particular cases, they should be preferred to expensive mine defences, constituted of a most changeable, but always delicate, material, tedious and difficult to prepare, and the working of which is very problematical, and not free from peril. Even the small torpedo-boats, of a type now antiquated, and considered useless for an attack against ships in the open sea, might be usefully and very conveniently substituted for numerous mines. If nothing else, they constitute a species of movable mine, with all the advantages that mobility and the attack have over the fixed and passive defence; it would certainly not present more difficulty to hit the mark with their torpedoes than to explode a ground mine for the same purpose, in spite of stations of observation, illumination, and discovery, and all the complicated implements, rules, and prescriptions necessary for the supervision and working of a mine defence; and the inconveniences relative to mine defences become most serious at night, either by the difficulty in distinguishing the friendly ships from ships of the enemy, or because of the difficult problem of assuring precise and concordant action at the look-out and illuminating stations, and those of observation for the explosion of the submarine mines. It certainly is our opinion that, in spite of the most minute

and stringent regulations for reconnoitring, the ship which, when followed by the enemy, attempts to find shelter in a port the entrances to which are guarded by mines will run great risks, and very probably the Captain of such a ship would prefer to remain outside at any risk, except when constrained to try it by motives of absolutely imperative necessity. Besides, we may hold that no enemy's ship, unless in very particular circumstances, would attempt to force a passage defended by mines, especially at night; very probably the ships which operate against a fortified place will seek to do all the damage they possibly can by simply coming as close as they can to the protected points, and for this reason the small torpedo-boats would prove much more useful than the mines, because they can operate against the ships so doing.

The defence by torpedo-boats will always have a moral effect at least equal to that of the mines; and as to material effect, they will have all the advantages that the attack, mobile and sudden, has over the defence, immobile and passive.

We will only remark on the controllable torpedoes, such as the Brennan, Sims-Edison, and others, for coast defence that, without wasting time in discussion on such weapons, we think it will be worth while to occupy ourselves with them when their inventors are able to tell us how they will judge, in spite of lights and indicating flags, whether their engine of destruction is 10 or 100 metres off the target, and how, therefore, they will be able to direct them and time the explosion properly, from a distance of 1,000 metres or more, especially at night; and this without speaking of the many other serious inconveniences peculiar to these kinds of weapons. Up to the present they have only been useful to those of their inventors who have succeeded in getting them adopted by some one, and we do not believe that they will ever contribute to any more conclusive end for the purposes of maritime war. The history of controllable torpedoes, in our opinion, is somewhat similar to that of the dynamite gun, of ships with wonderful rams and variable immersion for action, and of that of numerous submarine boats, and many other inventions relating to maritime war, viz., grand descriptions, many promises, wonderful experiences, but more or less complete shipwreck in practical employment, either in war or navigation.

In conclusion, with regard to coast defence under its varying conditions, we again repeat that, in our opinion, the best means for carrying it out are the employment of numerous torpedo-boats, large and small, modern or obsolete, and in the limited use of simple obstructions or batteries of automatic torpedoes, in order to absolutely enclose particular positions under given circumstances. In this manner a defence will be obtained which can be most rapidly prepared, the employment of which will be much less problematical, will be, morally and materially, much more effective, and also certainly much more economical.

THE MILITARY SITUATION IN UPPER EGYPT.

By Major von Wissman.

(Translated from the "Militär-Wochenblatt," by permission, by Commander H. Garbett.)

Though the military affairs of nations whose method of warfare differ from the European are of interest to Germans who follow the calling of soldiers, this has become still more the case since Germany entered the ranks of the Colonial Powers, and it behoves her to take lessons from the older of those Powers in matters relating to Colonial military systems.

As the duty fell upon me three years ago to establish the first German Colonial corps, it was of special interest to me to make myself acquainted with the English military Colonial systems, and I joyfully seized the opportunity afforded me by a journey up the Nile for my health to study the soldiers of the Egyptian Army who had been trained by English Officers. It was of special importance to me to see the Negro battalions, because the major portion of the German force in East Africa is drawn from men of the same Sudanese races as the Egyptian black battalions. In Egypt the Sudanese are considered as distinct from the Egyptians; they form the infantry and are looked upon as the flower of the Army and the most trustworthy in war.

The Egyptian fellah is in many respects superior to the negro; he is more muscular, more intelligent, and a better rifleman, but he is far inferior in soldierly *moral*, and this one defect outweighs all the other excellent points in him. I said in soldierly *moral*, as in regard to common human *moral* the above observation does not apply. The Egyptian is more temperate and less given to quarrelling, for which reason the black battalions are never garrisoned in the large towns, but are always stationed on the frontier before the enemy. The Egyptian is, I might say, a better peace soldier; the Sudanese has more soldierly instinct and is a born field soldier, he serves in the Army so long as he is fit for active service; the fellah, on the other hand, only for six years; and after he has completed his service, returns to drive his camels, or plough with his buffaloes the fruitful valley of the Nile.

The Egyptian Army has as its tactical unit only the battalion, the squadron, and the battery; it is at present from 10,000 to 12,000 men strong.

The Egyptian battalions have four companies of 150 men each, the Sudanese battalions six companies of 100 men, whilst the squadron numbers from 70 to 80 horses.

Nearly half the Army is distributed in Lower Egypt, in Cairo, Alexandria, Suez, and at Suakin on the Red Sea; the remainder is distributed along the Nile on the high road from Egypt to the Sudan.

Suakin is the port of exit of the best and shortest road for an army to the capital of the Sudan, and will in all probability become the base of operations in the event of future operations against the Mahdi. I turn now to the Nile Army, which, since the last attempt of the Dervishes at Toski, in 1888, to force their way into Lower Egypt was frustrated, forms Egypt's wall of defence against the Mahdi's forces.

The state of readiness of this Army, whose reserves are stationed in Lower Egypt, is in the first place conditional upon the state of the Nile, the only route for an army. Wide stretches of country on each side of the Nile are impracticable on account of the want of water.

The Nile is navigable from its mouth to the First Cataract, at Assouan; and from there again to the Second, between Wadi-Halfa and Sarras. At the Third Cataract the outposts of the Mahdi are to be found, and, although it is now two years since any exchange of shots took place, he is still considered by the Egyptians as a hostile rebel, while he on his side, in his own interest as a ruler, cannot conclude peace. Between the Nile and the Red Sea dwell Nubian tribes, principally the Bischarin, who acknowledge the Egyptian Government, and are responsible for the security of the left flank of the Egyptian position on the Nile.

The left bank of the Nile is for a considerable distance unpopulated, for the Bedouin tribes belonging to the religious sect of the Senoussi, who live on the western borders of Lower Egypt, do not extend as far south as Assouan, where the civil administration of the Government comes to an end and the military begins, which latter embraces that portion of the Nile valley occupied by the Field Army, and is under the charge of the Sirdar, the English Commander-in-Chief of the Army. It is worthy of remark, the length of time English Colonial experience leaves a country in which absolute security does not yet reign under a military administration, and in a measure in a state of siege.

As we enter the military province at Assouan, below the First Cataract, we first meet with the reserves of the frontier forces, who are advanced as far as the Second Cataract. Everything can be brought as far as Assouan from Lower Egypt by means of steamers. A short railway on the right bank is laid round the cataract and conveys the traffic to the portion of the river which leads to the frontier. Assouan, garrisoned by two battalions, and the railway and landing place opposite the island of Philæ, above the cataract, are protected by a number of small forts which crown the edge of the Nile valley. Two river gunboats armed with one heavy and two machine-guns secure the traffic between the two cataracts, which is carried on by means of ten steamers. Half way between Assouan and Wadi-Halfa, on the right bank, lies Korosko, which is fortified and garrisoned by one battalion; it is the resting place for the night for boats making

the two days trip from Assouan to Wadi-Halfa, and is also the starting point of the great caravan route to Berber and Khartoum, which cuts off the great bend of the Nile to the west, the river for some distance on being a succession of cataracts. Wadi-Halfa, below the Second Cataract, is the headquarters of the frontier field force, and is garrisoned by two battalions, two squadrons of cavalry, a mule battery, and a camel corps. The place is fortified and secured by small forts distributed along both banks of the river. A railway on the right bank, protected by small forts, runs round the cataract, which extends for a distance of nearly twenty miles, to the advanced post of Sarras above the falls, where there is a garrison of a battalion, a squadron of cavalry, and a camel corps, the latter performing the scouting service towards the Soudan. I may here observe that the fortifications, although they may be sufficient against such an enemy as the wild Dervishes, would without exception be quite untenable against an enemy provided with good artillery. The bricks made out of the tough Nile mud are ready to hand and the cheapest building matériel. In one respect the forts are disadvantageously situated; in order to effectually command the river they have to be placed as near as possible to the brink, and consequently on both banks they can be threatened from the edges of the plateau commanding the Nile valley. The choice of positions is limited, as the landing places above and below the cataract, as well as the connecting railway, have to be secured, while for a considerable distance the Nile valley is very narrow, and, as already remarked, commanded by the brow of the desert; there are only a limited number of small detached forts on the heights, as any extensive fortification of the commanding points would require a considerable body of troops to man them. The design of the forts also is open to further criticism. There is no application of any known system; unenfiladed ways and dead angles are numerous, and there is often a want of flanking works; the height of the walls and depth of the ditches, which are dry when the Nile is low, are depended upon alone as the protection against their being taken by storm. The small forts are mostly square houses, which are entered by means of ladders, and are defended by the crenelated parapets of the flat roofs. My opinion as to the condition of the troops I will leave the reader to form his own judgment upon, while I put before him my observations in turn; only I must put forward two common points of view, which place in the right light the great military Colonial experience and the practical common sense of the English Officers. In an army, the matériel of which is composed of different races, the most important question is, whether the troops are completely trustworthy and under the proper control of their Officers. This is especially a burning question in Egypt, since it is not long ago that the mutiny under Arabi Pacha gave us an example of the rudest kind of the contrary.

Although the English Officers have to pay special regard to the views of the Khedive and his Government, and that for this reason a number of Egyptian Officers are placed even in the position of Battalion Commanders, nevertheless they have been extremely successful in

winning the complete confidence of their men. Another point worthy of remark is that the men have been educated into self-respect, into a recognition of the honourable calling of a soldier, and into a certain pride in their position. Anybody who knows what the Egyptian conscripts used to be, and how their detestation of serving in the Army was shown by their numerous self-mutilations and desertions, who has seen the fellaheen wallowing in dirt in their villages, which have all the appearance of dungheaps, who is acquainted with their servile cringing habits, must stand astonished at the present self-respecting bearing of the cleanly and carefully dressed soldiers.

In the camp at Sarras I saw every tent environed by a flower garden neatly enclosed with white stones, and everything in and about the men gave proof not only of cleanliness, but of a certain sense of comfort. This is a result which could only have been arrived at after great trouble, and is entirely due to the efforts of the English Officers. It is sad to hear from the same Officers that this improved state of the men only lasts until they return to their dirty villages, but it is a sign that with proper education something can be made out of the poor, servile, and dirty fellaheen.

The Commandant at Wadi-Halfa, Lieutenant-Colonel Kempster, received me in the most friendly manner, and begged me to let him know what I wished to see; consequently on the first day I inspected the barracks of two Sudanese battalions. All the troops are quartered inside the fort in airy barracks constructed out of Nile bricks. As the Sudanese are for the most part married, one-fourth of them are allowed to leave in turn to spend twenty-four hours with their wives in the adjacent village, returning, however, for duty during the day.

On entering the barracks the men were called to "attention," and stood up in front of the bed-places which ran along the walls; they were in working dress, but were, however, military in their bearing and neat in their outward appearance. The bed-places, constructed of clay, were covered with a straw mat and a couple of woollen rugs. The arms stood in racks in the middle of the corridor, while the clothes and accoutrements hung on the walls over the bed-places. In the afternoon, upon the "alarm-place of assembly" of the centre fortification, a great game of football took place. About 100 Sudanese and some English Officers were playing. It speaks well for the military instinct of the Sudanese that an unbending of the Officers in this way in a spirit of comradeship does not cause any breach of discipline, but rather tends to raise the soldierly pride of the men; in the case of the Egyptian soldiers, with whom a more Oriental submissiveness predominates, and where there is an absence of the devotion engendered by comradeship which distinguishes the Negro, familiarity of this kind has to be avoided. On the second day of our stay we made a visit to Sarras, the most advanced post of all. The railway carries one past the Second Cataract, which presents a strange wild picture, and ends under a wall of rock rising precipitously out of the desert sand, and which is crowned by the citadel of Sarras. Sarras is armed with two heavy and two machine-guns, and lies close on the

Nile. What a magnificent climate it is, which allows of troops camping out all the year round in tents without suffering from the weather!

The Commandant of Sarras, the picture of a lank Anglo-Saxon warrior, Major Sillem, had the alarm sounded in order to show me the manning of the different posts. The troops were rapidly in position. It was a pretty warlike picture to observe from the summit of the crag, the men doubling to their stations between the small flower gardens and the tents, but the hurly-burly was soon over and the bugle-calls rapidly obeyed. The camel corps was sent forward as if to ascertain the cause of the "alarm." This corps is mounted on dromedaries, which are only ridden for scouting purposes, the men when necessary fighting on foot; it may be said to form a connecting link between cavalry and mounted infantry, such as the English have employed with much success in India and elsewhere. For a long day's patrolling in the desert the horse is far inferior to the camel, and good men armed as infantry on rapid dromedaries have been found best for the purpose. When fighting, the men dismount; three men fight, while the fourth leads the four camels, keeping them under cover in the neighbourhood of the fighting line. The great difficulty in training the dromedaries lies in getting the animals to lie down rapidly for dismounting, and still more in allowing themselves to be quietly mounted. Very few camels will remain quiet while this is being done. Attacks with camels should not be made on account of their obstinacy and want of speed for short distances. It is remarkable that the camel corps have no weapons for use against pursuing cavalry, which are faster over short stretches; I think myself that the revolver would be the most suitable weapon.

Upon our return to Wadi-Halfa the wildness of the naked black rock wilderness of the Second Cataract filled us with astonishment.

The result of an inspection of two battalions the next day was the conviction that the clothing and equipment of the troops is sufficient and answers all purposes, and that a careful and well-regulated supervision is everywhere exercised.

On the last day of my stay my worthy host the Commandant of Wadi-Halfa ordered a field day of the whole garrison. The troops first fell in in parade order in line, the cavalry on the right flank, then a mule battery, and next four battalions, two Egyptian and two Negro. The cavalry consisted of two squadrons, the front rank being armed with lances, the staves of bamboo, and the second rank with carbines; the horses, although looking lean from the want of green food, which is difficult to procure, and without being very rapid in manœuvring, seemed, however, to possess good staying powers. Rittmeister von Schuckmann, who accompanied me, spoke highly of the efficiency of the men. The mules of the artillery, content with poorer food, were fat and smooth, strong animals with powerful depth of chest. I should doubt, however, if their stubborn natures might not render them unsuitable for the work in the event of the guns being suddenly required, but for transport purposes in the desert they are excellent.

The infantry stand well, even according to our standard. Some movements and changes of front followed, and regimental exercise of the four battalions, in which the favourite échelon formations of the English played a principal part. For the march in the desert in face of a mounted wild enemy swarming down on all sides, the important battalion square is formed by wheeling the two centre companies to form the sides.

Battalion squares in échelon was the unaccountable formation in which Hicks Pasha's army of 7,000 men was drawn up when the Dervishes forced their way between the squares, and the men in which, firing on all sides, mutually shot each other down until the last man was destroyed.

When there is not a sufficient number of cavalry, there is only one effective formation against a fanatical enemy swarming on all sides, and that is a large square formed of all the troops on the march with the train in the centre. As there are no roads in the desert, the troops can march with as wide a front as is pleased, and the formation can be rapidly taken up. Formation in open order can only under exceptional circumstances be employed against the Dervishes. I found my East African experience with regard to the advantage of reserving the ammunition for volley firing confirmed. As the infantry battalions are commanded by English Officers, and the companies by Egyptian, the Battalion Commander only when absolutely necessary separates his companies, and therefore such a battalion corresponds in its tactical handling in a certain measure with a company with us.

On the day we left I made a small expedition up the left bank of the river to a precipitous conical rock rising about 100 feet out of the water, at the foot of which the wild cataract forced itself foaming through hundreds of islets and black masses of rock. We were mounted upon dromedaries of the camel corps, and covered the distance of 10 English miles in an hour and twenty minutes at an easy trot. When it is considered that a dromedary can trot for eight hours a day, carrying its rider, his arms, ammunition, and four days' water, food, and fodder, and can keep its speed up for four or five days, it will be seen of what value the animal is for scouting and similar services. Unfortunately they cannot live in a damp climate, so they cannot be utilized in our possessions in East Africa.

Durrha (a species of millet) and coarse fodder of chopped straw, &c., are the food of the camels in garrison, while on the march the hard prickly bushes of the desert form their nourishment.

On my return to Assouan I had the pleasure of making the acquaintance of Wodehouse Pasha, the acting Sirdar, and thanking him for the hearty welcome I had received at the hands of his Officers. I have written these pages to my comrades at home to give them some idea of the work of the English Officers in the Egyptian Service, and in the hope that they may prove of some interest to many.

CAVALRY SWIMMING.

(Translated from the "Invalide Russe," No. 87, 1892, by Captain E. LAMBART, R.H.A.)

AN order by General Skobeleff to the 4th Army Corps, of the 15th June, 1882, contains the following:—

"I do not admit the possibility of men swimming on their horses in full marching order, except over very small streams with firm bottoms, and I consider that swimming, commencing with small rivers, such as the Sooprasl (105′ broad), and going on to regular rivers, such as the Danube, Wisla, Amoor, and Sir Daria, is best carried out by one of the following three methods, tried experimentally by three squadrons of the 4th Dragoons, on the 12th June."

The following is a summary of these three methods:—

(1.) *Narrow Rivers.*—The uniform and equipment of men and horses is carried over on rafts or small boats, and the men swim their horses over on watering bridles only.

(2.) *Broad and Swift Rivers.*—The men cross on boats or rafts with equipments as before; the horses, bitted up, swim over in squads, following a few guides, selected from the best swimmers, on their horses.

(3.) *In the Absence of Boats and Rafts.*—A few experienced swimmers, one of them tied round with a long, thin rope, swim to the opposite bank, and then with the rope pull across an axe and a picket rope, which is made fast to a stake or tree. The picket rope is then taughtened and made fast at the starting point. A detachment of the best swimmers is then sent across without their horses, and taking with them in a bundle round their necks the necessary clothing and their rifles, ammunition, and entrenching tools. This detachment takes up position to cover the crossing, establishing visual signalling communication with the rest. The remainder of the men then cross, holding by the rope, with their kits, &c., slung round their necks. The use of several picket ropes of course materially quickens the operation. Last of all, the horses are sent over in squads, with the bits on the rear arches of the saddles.

In connection with these orders of the illustrious Skobeleff, it is worth while to bring to notice an invention designed to materially assist cavalry in crossing rivers.

The invention (of a Sub-Lieutenant in the Semenorski Life Guards) consists of a canvas bag, waterproofed, and fitted with a cork that seals it hermetically. Its weight is about $2\frac{1}{2}$ lbs.; length, $4\frac{1}{2}$ feet; and width, $2\frac{2}{3}$ feet.

This bag, filled with the uniform and accoutrements of the man, and the whole of his saddlery, &c., and corked tightly, not only does

not sink, but can even support some additional weight. One end of the bag is fitted with a rope having a large loop.

On the 8th July, 1890 (says the writer), at the request of the inventor, I tried these bags on the River Sooprasl, near Baylostok, with excellent results. Accompanied by my orderly, I went to the river, and having packed our uniform, arms, &c., in the bags, and slung them round our necks, we jumped our horses into the water, holding on by their manes, and crossed the river backwards and forwards several times. The bags towed behind us, and did not hamper our horses in the water in the least. After this we tied the ropes to bushes on the bank, and let the bags remain in the water for more than half an hour, without any of the contents getting damp.

A pack animal, carrying 80 to 100 bags, might easily accompany each squadron in Dragoon and Cossack regiments on service.

In case of detachments of less strength than a squadron, the bags might be slung to the rear arch of the saddles. It would not do, however, to carry the bags on the saddles permanently, as they add to the already heavy equipment, and, besides, the rubbing would quickly wear out the bags; for this reason I suggest pack animals.

This invention certainly deserves attention, especially when we consider that, though swimming rivers is now part of the programme of our summer drills, many Officers and men fail to become good swimmers, owing to their being quartered at a distance from water. Moreover, even at manœuvres, there have been cases of drowning when the swimming practice is being carried out. In peace-time, as a rule, drowning men can be rescued, but in war there is no time for this, and though our cavalry are trained to make light of all risks on service, in the moment of the charge every sabre counts.

One of our most distinguished cavalry leaders says of this invention:—

"In the days of armed peace in which we now live, so valuable an invention must be made known as quickly as possible. I am personally convinced that this invention is of great importance in independent cavalry operations, in raids in the theatre of war, and particularly in 'partizan' warfare. If we make use of it, neither the Wisla, nor the Narva, nor the Bug will stop us."

COMPARISON OF THE MOST IMPORTANT REGULATIONS OF FOUR CONTINENTAL POWERS AS REGARDS THE ATTACK AND DEFENCE.

(From "Militär-Wochenblatt," June 29, 1892.)

Attack.

Germany.

The German Regulations make a distinction between the "Begegnungsgefecht" (improvised fight) and that on a prepared position; in the latter case the attack being in conformity with a prearranged plan, and preceded by a deployment; in the former case the fight is developed from the march, the deployment of the main body being effected under the protection of the advanced guard.

The attack is divided into three parts—

1. Troops are thrown forward to open fire on the enemy as near to his position as the ground allows.

2. Strong swarms of shooters work their way up to these troops and endeavour to conquer the enemy by fire. The only prospect of success lies in obtaining this superiority of fire.

3. When this superiority is attained, the shooting line, aided by supporting troops arrived close at hand, advance to storm the position. This order will, as a rule, come from the highest Commander, but the impulse (*anstoss*) for the attack may also proceed from the shooting line.

The retreating enemy is pursued with fire after the capture of his position.

An enveloping attack is recommended as conducive to success; but this is not to proceed from the developed fighting line but must be arranged for beforehand.

Russia.

The attack is divided into—

1. Advance.
2. Attack.

From the deployment ("Entwicklung der Gefechtsordnung")—about 2,000 paces from the enemy—to the entry within the zone of strong hostile rifle fire—800 paces from the enemy—the advance is continued along the whole front in quick time. From this point the attack is the object of all forward movements. The command has ascertained the position of the enemy, arranged the plan of attack, strengthened the shooting line, and given to all the troops the right direction in which to attack.

The advance is by rushes either of the whole line or by portions of the same. The last firing position from which the attack is prepared by fire is from 300—150 paces from the enemy. From this point the attack is with the bayonet. Reserves advance over open ground in line with open files. When the shooting line is in its last position (300—150) the reserves may not be further than 200 paces in rear of it. The reinforcement of the shooting line is carried out before advancing to the attack, at 800 paces from the enemy.

Austria.

The Superior Commander draws up a plan of combat. The offensive must always be taken. If possible the attack must be enveloping, and only frontal when a surprise or approach under cover is possible, or if any other direction for the attack is not available.

Under the protection of a preparatory fight follows the development of the main body next to the advancing line; later on the main body is pushed forward to those points from which the attack proper will commence, and at the decisive advance moves direct forward.

The principle is to arrive quickly as near as possible to the enemy. At long rifle range, 2,000—1,000 paces, the advance is by the whole line. At medium ranges, 1,000—500 paces, simultaneous rushes by whole companies; from 500 paces is carried out the decisive attack, after previous shattering of the enemy by fire. There must be a constant pressing forward everywhere. The order for the attack will, as a rule, come from the Supreme Commander ("Signal-Storm"), but the impulse for it may be given from the shooting line. At the moment before the decisive attack is made ("Beim Abbruch des Gefechts vor der Entscheidung") the reserves are to be sent back to take up on the flank a rallying position, but only there where obstinate resistance is intended.

France.

The attack alone can obtain decisive results.

Formations for the advance are to be chosen suited to the ground and screened from the enemy's view. No premature deployment; only when the enemy's fire renders it necessary will a shooting line be extended, sufficing for the opening of the fight. If the hostile fire is opened, fire will be opened in reply at 700 metres, otherwise as near the enemy as possible. The further advance follows from position to position, the intermixture of commands being avoided; the supports come up on the flanks and in the intervals. The supports gradually near the shooting line. As soon as fire reinforcements are necessary, half-sections or sections are sent forward in the intervals or on the flanks. This insertion of reinforcements gives the impulse to a further advance.

When the advance has arrived at 400 metres, the action is carried

on with the aid of the reserves, the advance being by 50-metre rushes of companies or in échelon. Those shooters left in rear may not fire if there is not interval available. At 250—200 metres bayonets are fixed. The shooters increase the fire, and direct it on to the point to be assaulted. The advance of the reserve to the assault is the signal for the storming, if the enemy has not yet given way. To the "storm pace" soon succeeds the "double;" with the cry "En avant à la baïonnette" all throw themselves on the enemy. This is conducted with the greatest energy.

The pursuit is carried on by fire. In case of failure of the attack, company leaders rally their companies quickly and endeavour to renew the attack, for the advance is always preferable to the destructive retreat.

Comparison.

In all four the attack is in three parts. The Russian primary division is of two, but the attack portion subsequently becomes two, making three.

The first is the advance towards the position up to the opening of fire.

The second is the carrying through the fire fight and advance up to the storming.

The third is the bayonet attack.

The four systems agree that the first stage is to be carried out with weak advanced troops; the extended shooters going forward in one body quickly as near to the enemy as possible. The Germans do not give any distance to which this first advance should be made, nor where it commences. The Russians and Austrians give 2,000 paces as the commencement. The French make the formation of a shooting line dependent on the enemy's fire.

The Russians consider up to 800 paces, the Austrians 1,000 paces, the French 700 m. (900 paces) as the distance from the enemy to be attained by the first general advance.

For the fire fight the Germans give strong swarms of shooters working their way marching or by rushes, and seeking to gain superiority of fire. The Russians and Austrians order rushes, the former to 300—150 paces, the latter to 500 paces, the former with the whole or parts of the shooting line, the latter by whole companies.

The French by rushes, company or échelon, up to 50 metres from the enemy; no mixing up. The Russians reinforce the shooting line at 800 paces before the commencement of the attack. The French accept 400 metres as the distance for the entry of the supports. The Germans and Austrians are silent on the subject. All four demand the shattering of the enemy by fire before the commencement of the storming.

All four have the advance to the storm carried out by the shooting line aided by the reserves. The Germans bring their

reserves for the purpose close up, the Russians at most 200 paces from the shooters.

With the Russians the bayonet attack commences from the last firing position, 300—150 paces; the French 250—200 metres from the enemy; the Austrians say the attack proper commences at 500 paces; the Germans give no distance.

Both Germans and Austrians leave the order for the decisive assault to the highest leader, or through impulses from the shooting line. The Russians and French are silent on the matter. All four pursue the enemy with fire; the French provides for a renewal of a failed attack.

It is to be noted that the German Regulations order the deployment before the fight; whilst the Austrian Regulations order the development of the main body, and, later on, its movement to those points from which the attack proper is to commence.

The Defence.

German.

The Regulations lay down as the principle:—"It depends on the profitable use of the fire-arms; thus is determined, therefore, the selection of the position and skilful strengthening of the same." The shooting line will from the commencement be as strongly held as is necessary for the object of the fight. The position is to be strengthened, the distances indicated by marks, ammunition distributed and kept in readiness; the supports are to be drawn forward and all distances in depth diminished. The number and breadth of the sections varies according to the ground; each is a unit of command with its own reserve.

The main reserve is to be placed where it can pass to the offensive, which is necessary if a victory is sought for. As a rule, this place is on one of the wings, the more to the flank as the defending force is larger; by this means the danger of turning movements is at the same time guarded against. The position is occupied as soon as the direction of the attack is known.

Russian.

As principles are accepted, advantageous employment of fire-arms, then counter-attack with the bayonet.

In selecting a defensive position the field of fire, cover, and distances are to be taken into consideration; weak points to be occupied more strongly, artificial cover and communications provided, flank protection is to be attended to. The development of fire takes place gradually, the ammunition is to be reserved for short ranges. The fire will be specially directed on the attacking shooters when they rush forward; the attack is repulsed by volleys delivered by the reserve from the shooting line. If the enemy does not hold his ground, the shooting line and the reserve attack him with the bayonet,

and where possible by a part of the reserve on his flank. The reserves must, therefore, for this purpose be drawn forward in time. After repulse of the attack, the enemy is followed up with fire. During a retreat individual shooters fire, positions chosen in rear are to be occupied; the reserves retire with the shooters in quick time.

Austria.

The principles are—Utilization of the ground and profitable employment of the fire-arm. The offensive must always be combined with the defence if a decisive success is aimed at. Field for fire, depth, freedom for movement, must be taken into consideration in choosing a position. The strength employed must correspond to the object of the fight; a weak occupation at the commencement is faulty. Patrols are sent to the front to watch. The position is divided into sections, each with its own reserve. Some points are more important to occupy than others; a uniform distribution of troops is incorrect. Independent points for defence receive special garrisons.

A strong main reserve is posted behind one flank. Until the enemy's intention is apparent the troops are held in readiness; the protection being entrusted to patrols. Reconnoitring, measuring ranges, arranging cover are to be taken in hand. The reserve is drawn forward near to the front line. As soon as the direction of the attack is known, the position is strongly occupied. On columns and guns fire is opened at long ranges; on the most threatening enemy at medium ranges; at short ranges fire from all available troops.

If a counter-attack is intended the main reserve may not be employed for any other purpose; it must deploy quickly when the attacker has arrived at deciding distance, open on him a powerful flanking fire, and then attack with the bayonet. Counter-attacks from the shooting line are to be avoided.

If a counter-attack is not intended, the main reserve strengthens the shooting line or meets any flank attack. Pursuit is carried on by fire.

French.

The defence relies on fire and suitable employment of ground. Passive defence is absolutely rejected. Active defence turns to account the advantage of the choice of ground and the expectant attitude, only as an increase of strength in order to beat the enemy in a known position more certainly and under more favourable circumstances.

The Commander pays attention to the advantages for offence and defence, the line of defence, supporting points, flanks, communications to the front and in rear; points of assembly and line of retreat. According to these considerations follows the distribution of the

sections to the lower commands and the construction of defensive works.

The lower leaders at once make themselves acquainted with the ground in front of them and the contiguous positions, find supporting points, ascertain ranges and communicate them to those under their orders. The Commander of the support marks the lines of approach to the line of defence.

If the fight is not to commence at once the Commander sends forward only enough men to watch and to carry out the defensive works. The remainder are held in readiness to advance in a protected position. The formation is generally the same as that for attack. The front to be held by a company is about 200 m. (220 yds.), without uniform occupation being necessary.

The choice of position for the supports depends on the probable fall of the enemy's projectiles. If the ground allows, the depth of the formation is to be diminished. On the approach of the enemy the patrols report his strength, proceedings, and direction of his attack; their first resistance can compel him to deploy and reveal his intentions. On this the Commander comes to a decision. As soon as the attack is pronounced the position is occupied.

Fire is opened as soon as it becomes effective. The intensity of the fire depends on the range and the importance of the target; the best shots fire on the hostile leaders. When the enemy approaches, and his fire increases, the supports gradually strengthen the shooting line, in order to give the necessary amount of fire. The reinforcements should either prolong the line or enter it, never causing it to close. Detachments will be told off to fire on the supports and reserves, whilst the others reply to the fire of the enemy's shooting line. By the time the enemy is arrived at 400 m. (430 yds.) from the position, ordinarily the supports will have been absorbed in the shooting line, and the defence will be continued with the aid of the companies in reserve. The counter-attack is carried out by the companies in reserve. If the attack fails, the pursuit is continued by fire, and the defence prepare to assume strongly the offensive. If the attack succeeds, the companies are disengaged under the protection of the fire of closed detachments, and collect at some spot determined beforehand by the Battalion Commander.

Comparison.

All four Regulations bring forward prominently as the main principles the utilization of fire and the judicious use of ground. As regards the former, the Russians develop fire gradually, the French, on the contrary, order fire to open as soon as the enemy can be hit; the Germans act according to their own musketry regulations. The Austrians use fire mainly at medium and short ranges, and only at long ranges where the ammunition is sufficient and the target large. All the regulations, with the exception of the Germans, recommend the constant employment of volley firing. As regards the choice of the position and the measures for strengthening it, the regulations are

in accord, as also in respect to the division into sections, diminution of depths, section reserves in readiness in covered positions, a sufficiency of troops for the occupation of the position when the line of attack is known, and an independent main reserve, if possible behind a flank. On the last point, the Germans emphasize the advantage of a simultaneous flank advance, and expressly lay stress on the fact that it is wrong to hold back the main reserve to protect the retreat, instead of employing it in the fight. The French reject, *in toto*, the passive defence, and insist always on the offensive. The Germans and Austrians only if a decisive success is intended. The Russians on the order of the Commander, if the assailant is to be shattered.

From the foregoing it is evident that the four Regulations are practically in accord as regards the attack and defence. Success depends, therefore, on which troops are best led, trained, and disciplined.

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6th ...	W. T. C. Ash ...	1,606	20th ...	E. C. F. Woodhouse
7th ...	C. B. Prowse ...	1,587	24th ...	W. Maurice [illegible]
8th ...	J. C. Meek ...	1,566	27th ...	R. G. S. Bright ...
9th ...	C. D. Christopher ...	1,563	29th ...	T. K. [illegible]
	A. K. C. Savile ...	1,561	34th ...	H. E. Scott Harding
12th ...	A. J. Lean ...	1,578	*42nd ...	C. H. Pringle ...
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